PUBLIC WORKS

Oct. 1957

CITY, COUNTY AND STATE

A complete text for reference and instruction

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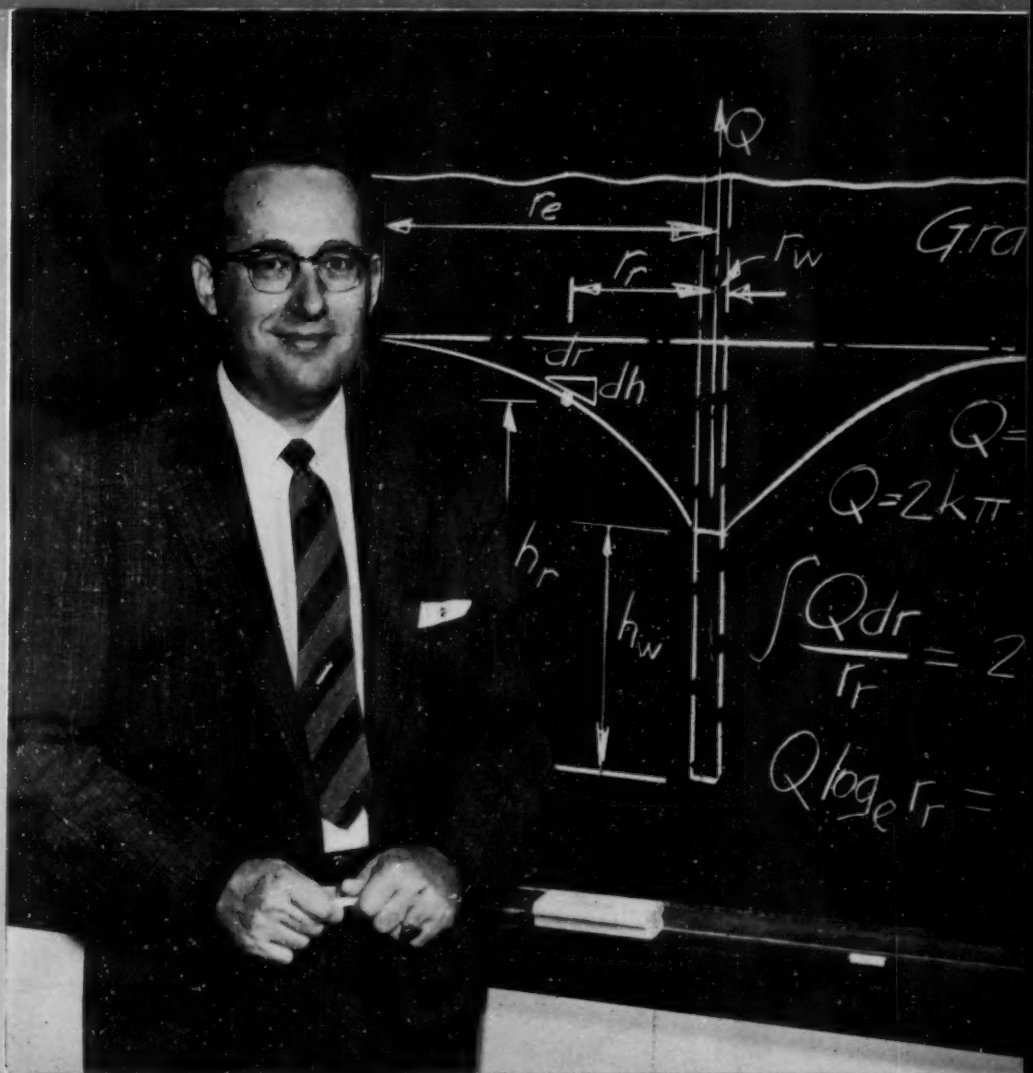


Kenneth W. Cosens, Associate Professor of Civil and Sanitary Engineering and Acting Chairman of the Department of Civil Engineering at the Ohio State University, has also had wide consulting experience. **See page 20.**

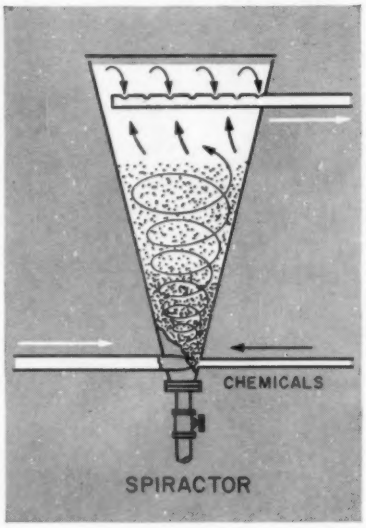
HOW TO SELECT WATER-CONDITIONING EQUIPMENT (NO. 3 OF A SERIES)

Precipitation Equipment

Basically, precipitation equipment converts water impurities to the form of large, dense, suspended particles; then it separates these particles from the water.

The first step is accomplished with chemicals. Hardness, for example, is precipitated by adding lime (and soda ash, if required). The precipitated hardness and other suspended impurities such as turbidity or oxidized iron and manganese are made to coalesce into larger particles by adding alum or iron salts. These salts also form their own dense, floc-like precipitate which absorbs the suspended material to form even larger particles.

The insoluble particles must then be separated from the water. Early methods used settling basins where precipitates settled slowly as the water flowed through, requiring 2 to 4 hours or longer detention time. Modern equipment keeps precipitates in suspension to serve as nuclei on which fresh precipitates form. This results in larger, denser particles that absorb more of the fine particles and are more easily separated from the water.



SPIRACTOR

PRECIPITATOR for removing hardness, turbidity, color, iron, manganese.

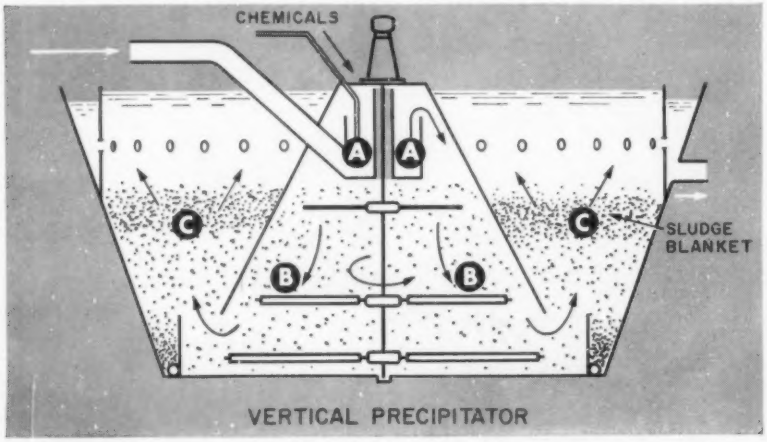
Chemicals are mixed with influent at A. As water flows downward through zone B, precipitates form, "seeded" by recirculated sludge. At C, floc has formed a sludge-blanket filter suspended by upward motion of the water. Excess sludge is concentrated and periodically drawn off.

Because of short detention time, capacity is about 4 times that of conventional coagulation and settling basins of the same size. Basic designs include vertical types as illustrated, vertical types for installation in existing tanks, horizontal types built into new or existing concrete basins and smaller "package" types for bottling plants, etc.

SPIRACTOR® for softening clear hard water.

The water, lime (and soda ash if required) enter at bottom of cone. The treated water rises with a swirling motion and suspends a bed of fine granules of calcium carbonate or other catalyst which speed softening reactions. The precipitated hardness deposits on the granules which become heavy and work down to the bottom of the cone where they are drawn off then easily dried and dumped. The softened water rises above the bed of granules to the outlet.

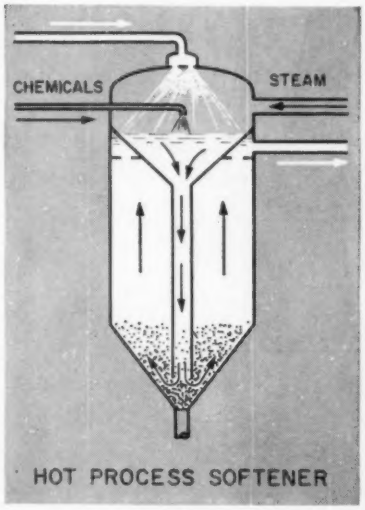
Provides very high flow rates in relation to its small floor space. Detention period: 8 to 10 mins. Recommended for municipal or cooling water.



VERTICAL PRECIPITATOR

HOT PROCESS SOFTENER for removing hardness and silica from boiler feedwater.

The water is first heated to within a few degrees of boiling by spraying through steam. Then it is mixed with softening chemicals which react very rapidly and efficiently at this temperature. It then flows down to the bottom and upward through a suspended sludge blanket of precipitated solids which effectively reduces silica and filters out the bulk of the turbidity. Combination softeners with built-in condensate heater and storage compartment and/or steam scrubber (deaerator) are also available.



HOT PROCESS SOFTENER

The effluent is filtered to remove last traces of suspended matter. Where zero hardness is required, Hot Process Softeners may be followed by a zeolite softener.

• • • •

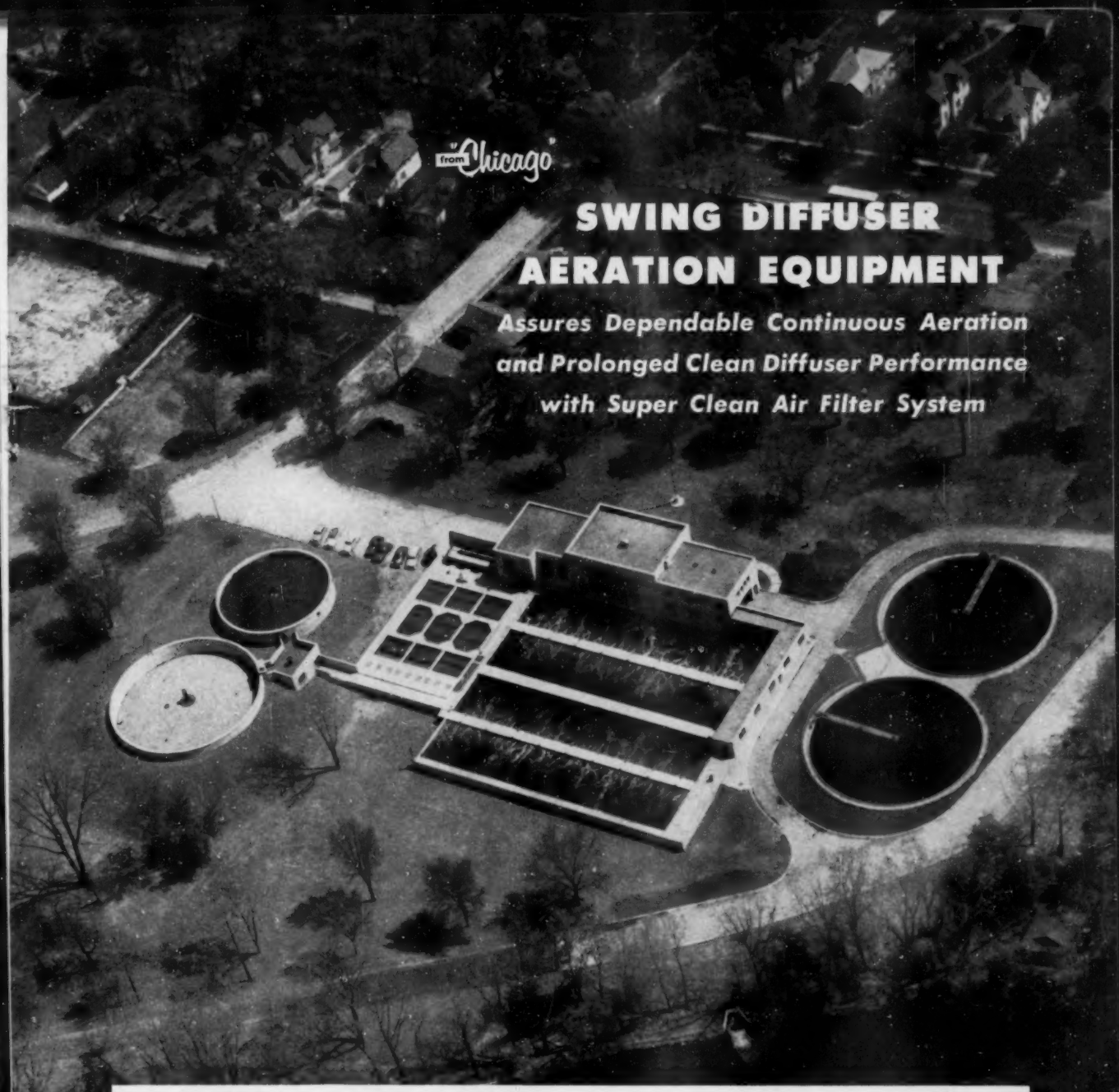
For detailed information on these or any other types of water conditioning equipment, write: The Permutit Company, Dept. PW-10, 330 West 42nd St., New York 36, N. Y. or Permutit Company of Canada, Ltd., Toronto 1, Ont.

PERMUTIT®

rhymes with "compute it"

Water Conditioning

Ion Exchange • Industrial Waste Treatment



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Assures Dependable Continuous Aeration and Prolonged Clean Diffuser Performance with Super Clean Air Filter System

Mishawaka, Indiana Sewage Treatment Plant — **Charles W. Cole & Son, Consulting Engineer**

- Uninterrupted, dependable sewage aeration.
- Continuous highest oxygenation efficiency available as required now or in the future.
- Low maintenance, economical Super Clean Air Filter System allows less than 0.09 mg. of dirt per thousand cubic feet of air, minimizing particulate clogging.

OVER 10,000 "SWINGS" INSTALLED IN MORE THAN 300 PLANTS TO DATE

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Sewage and Industrial Waste Equipment

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Chicago 14, Illinois

CAT* No. 212

does a man's size job in Cle Elum

The City of Cle Elum, Washington, has 32 miles of streets and an average winter snowfall of 60 inches. All snow clearance is handled by a sturdy Caterpillar No. 212 Motor Grader, now 5 years old. With blade extended, it bucks the snow into windrows in the middle of the town's wide streets, leaving a traffic lane on each side. After one 14-inch fall the machine cleared the entire city in one shift!

Street Superintendent Angelo Sibillia says: "It's a wonderful piece of machinery. It gets the snow off the streets in a hurry—a great help in keeping the town functioning normally."

While the No. 212 is the smallest and lowest priced grader in the Caterpillar line, it's built with all the rugged stamina found in the larger machines. Its dependable 50 HP Cat Diesel Engine is balanced with weight, speed and traction for steady performance. And it's built throughout by one responsible manufacturer, backed by one reliable service source.

The No. 212 is an ideal machine for year-around work in many smaller communities. It costs less to buy, less for fuel and repairs. It's built to stand up year after year with practically no down time. Operators like its positive-acting power controls, easy, accurate steering, quick blade positioning and complete job visibility from the seat. New *tubeless tires* are an added economy feature. They eliminate tube and flap trouble and greatly reduce tire down time, yet cost no more.

Let your Caterpillar Dealer show you how a No. 212 can save money for your municipality. His complete parts and service facilities will stand behind your investment.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

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BPA

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THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

you get all this with

AMPLE DEFLECTION
Photo shows how easily Clow Bell-Tite joints handle casual curves or normal grades without fittings.

TIGHT JOINTS
Full length, restrained joint, bursting tests prove Bell-Tite joint, even fully deflected, is stronger than the pipe.

FAST INSTALLATION
Above, Clow 8' Bell-Tite pipe being installed at the rate of 25 joints per hour. No bell holes are required.

SIMPLE ASSEMBLY
Wipe clean, lubricate, and push spigot into bell. When painted yellow stripe disappears, joint is bottle-tight!

CLOW BELL-TITE JOINT*
cast iron pipe

Here's the new time-saving, labor-saving, money-saving way to lay watermain. A single gasket, rubber seal joint that requires no bolts or follower glands to make a tight, dependable joint. Listed by the Underwriters' Laboratories, Inc., for water working pressures up to 350 psi, the pipe itself meets all applicable provisions of AWWA, ASA, and Federal Specifications. Complete details gladly rushed to you on request.

*Patent applied for.

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POINT OF VIEW

Development of Engineers Should be on a Broad Basis

THERE ARE SOME risks in the current program to mitigate the shortage of engineers by using them only in work requiring engineering skills. Principal among these is the risk of unbalanced or inadequate experience. It would be a grave mistake to raise up a crop of narrowly equipped engineers. What the nation—and the profession—needs is men with that wide experience which will give them the ability to conceive, organize, administer and direct the gigantic works of the future. Such ability is necessary because politicians, lawyers and doctors are certainly not equipped to do this work; yet, if engineers are not able and willing to take the lead and supply the imagination and skills required, others will do so, even though inadequately.

Our engineering organizations should be planned and administered with a view toward quick development of capable young men, providing them with the necessary background of knowledge, yet leaving full opportunity for progress. Making decisions is an essential phase of development and any good organization should insure that its young men must learn to make decisions as they progress. There is no quicker way to develop a man; nor to show his weakness, perhaps in time to overcome it.

It goes without saying that, even more than good organization, a wise and understanding chief is essential in developing our engineering personnel. Fortunately, there are a good many of them in the profession.

Entrance Driveways and the Modern Low-Hung Automobile

THE MODERN automobile hangs over at both ends and is getting wider all of the time. Also, it lacks the road clearance that was common in the days of the Model T. The length and width that are normal today have been a real financial pain to owners and operators of garages that were built in the old days without any idea that motor car dimensions might change.

The raucus squawk that we hear quite often these days comes from the rear ends of these long and low hung cars as they scrape on sidewalks or pavements going into or out of driveways. And sometimes the front ends scrape too. It is going to be a big job to reconstruct our existing driveway entrances to provide for whatever the automobile manufacturers may bring out in the future. Maybe it isn't possible; however, consideration ought to be given to a design for new construction that would have such a contour as to avoid end-scraping. There is no sense in continuing to build our new entrances to the same designs we have used in the past, if conditions of use have changed.

The problem is not a simple one because it is tied in with curb height, space between the sidewalk and curb (if any) and width of sidewalk. We invite our readers to submit designs which provide for these 220-inch or longer cars mounted on much shorter wheelbases. A simple and widely usable design will be welcomed by many engineers.

The Cordiner Pay Plan for the Armed Services: Another Viewpoint

WE CANNOT FULLY agree with the plan recently proposed by Mr. Cordiner's committee to increase the pay scale of various types of technical or technician personnel in the armed forces. The plan is based on the cost to the government of training men who shortly leave the service for better pay in industry. The idea is that, if these men are retained in the service, training costs can be reduced and the overall expense held even or lowered.

However, we must remember that an old army is not much good, for war is a young man's game. A relatively small percentage of personnel may be retained in the services indefinitely without reducing efficiency; but to overdo this is unwise. In this respect, the Army, Navy, Air Force and Marines differ distinctly from industry where middle age is not such a serious problem.

Furthermore, an important function of our military services is to train men who, after release from duty, can constitute a trained reserve, available quickly in case of emergency. While such a reserve ages rather quickly it does so little faster than men retained in the services. Reservists, however, may lag behind in knowledge of arms developments which, of course, are proceeding very rapidly these days. It should be possible to handle this problem by a good program of reserve training; and if this is provided, military personnel turnover is not wholly disadvantageous.

The more the picture changes

Our American water picture has changed drastically since the first cast iron pipe was laid over a century ago. Today, 44 public utilities in the United States and Canada still use cast iron water mains installed 100 and more years ago! *Modernized* cast iron pipe, centrifugally cast, is even tougher, stronger, more durable. Even more efficient than the cast iron pipe whose unique record for longevity has remained unchallenged through a century of technological progress.

Two of four parallel lines of 10" Mechanical Ball Joint cast iron pipe being installed across Mobile River, Ala.

CAST IRON PIPE

the more it is the same

Cast iron pipe to be installed for sewers and other services at industrial plant at Bellwood, Ill.

More than a mile of cement-lined, seal coated Mechanical Joint cast iron pipe carrying mine water for coal company at Sumiton, Ala.

CAST IRON

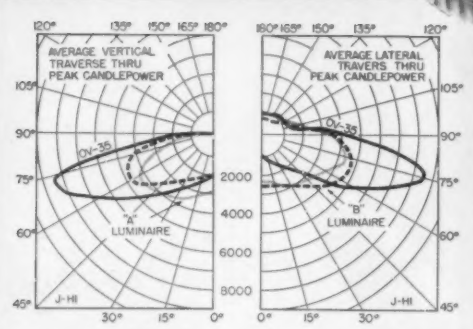
Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, Suite 3440, Prudential Plaza, Chicago 1, Ill.

SERVES FOR CENTURIES...

2 to 3 TIMES MORE LIGHT—at

with Westinghouse, Advanced-

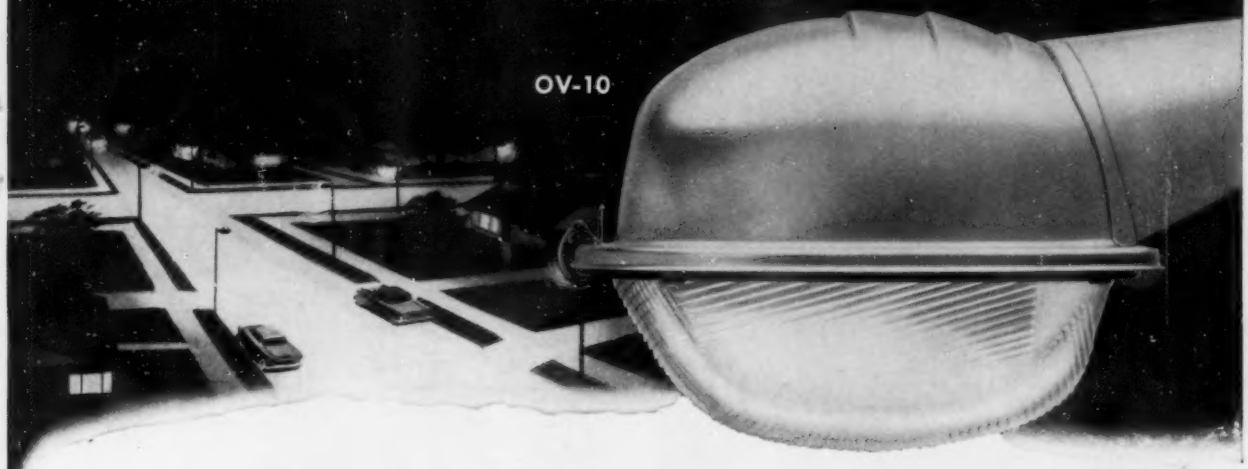
OV-35



See how OV-35 produces "practically twice" the candlepower of luminaires not designed specifically for fluorescent mercury lamps!

OV-35 candlepower curve is from J-H1 400 W color-improved lamp (OV-35 also utilizes B-H17 430W and B-H18 700 W lamps). Note how curves for A and B luminaires (designed *only* for *plain* mercury lamps) show *"practically half" the candlepower* when tested with the *identical lamp employed to produce the OV-35 curve!*

NO APPRECIABLE INCREASED COST!-
type MERCURY LUMINAIRES!



OV-35 THE ONLY "Mainstreet" Luminaire Engineered and Designed Specifically for color-improved Fluorescent Mercury Lamps!

"Mainstreet" lighting is now accomplished at *new peaks* of lighting efficiency! Yet at *negligible, if any,* increased operating cost!

This is due to exclusive Westinghouse developments now permitting OV-35 Luminaires to deliver *full* advantage of *color-improved Mercury lamps!*

It's well-known that *mercury* light-sources give up to *three times more light per watt* (than old-fashioned light-sources)! And also *out-last* old-style lamps by as much as *seven times!*

So, now Westinghouse, *alone,* has engineered the OV-35 Luminaire *specifically for* these superior mercury lamps—the OV-35, featuring an *exclusive, sealed* optical system, that *keeps out* bugs and water—and delivers this *greater* illumination, with *unparalleled* efficiency, *directly onto the road-way!*

This OV-35 has a housing of cast aluminum—a special glass refractor of *custom prismatic* design!—a reflector of Alzak Processed drawn aluminum.

Its slip-fitter provides quick, easy mounting and adjustable alignment. Its automatic latch permits fast, "one-hand" maintenance. Yet the seal is *tight* on *special* gaskets! The OV-35 is moisture-*proof* and bug-*proof!* This OV-35 *itself* is accredited for *many* of the advancements in modern "mainstreet" lighting today!

OV-10 Now Brings the Same, Ideal-type Illumination to Residential Streets!

The OV-10 has been engineered identically, to complement the famed Mercury Lighting Line of Westinghouse OV Luminaires, *preferred* by *most* street-lighting engineers!

The OV-10 delivers the same "*2-to-3-times-more-light*" and the *same* extraordinary *economy* for the proper lighting levels of *secondary streets!*

The OV-10 utilizes L-H4 100 W, A-H22 175 W and C-H5 250 W lamps. It has, in general, the same marked design and construction superiorities of all Westinghouse street-lighting luminaires. One simple move of the socket gives a choice of light-distribution to suit illumination requirements for virtually *any* secondary street!

All Westinghouse OV Luminaires are available now!

through your near-by Westinghouse Representative. Write to your own local Westinghouse Distributor or Westinghouse Electric Corporation, Cleveland, Ohio.

J-04423-R

WESTINGHOUSE LEADS ALL OTHERS IN THE ENGINEERING, DESIGN AND DEVELOPMENT OF MERCURY ILLUMINATION FOR ALL ROADWAY LIGHTING APPLICATIONS!

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OV-20 LUMINAIRE (E-H1 & J-H1 400W; A-H24 & B-H24 430W lamps)

OV-60 LUMINAIRE (A-H18 & B-H18 700W; A-H15 & B-H15 1000W lamps)

TIME AFTER TIME

Trickling Filters with T. F. F. I. SPECIFICATION VITRIFIED CLAY UNDERDRAIN BLOCKS

for Sewage Treatment Plants

because

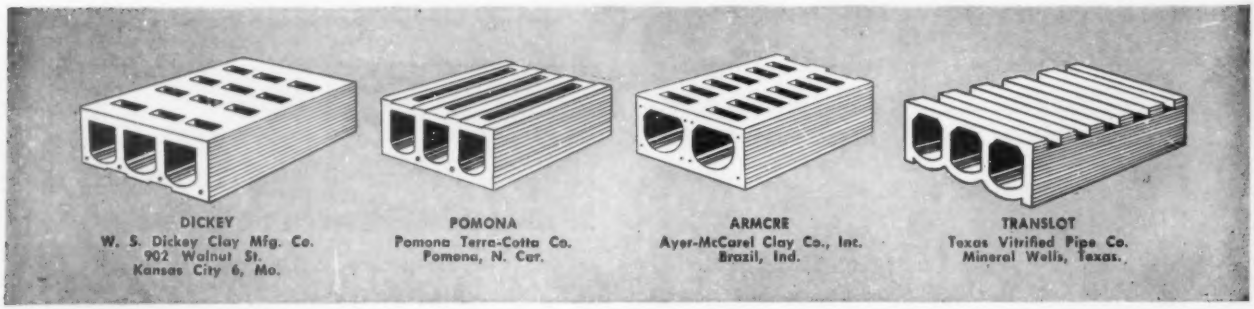
They combine these 6 big advantages

1. LOW COST. First costs are reasonable, and low-cost operation will save your community money.
2. SIMPLE, EASY OPERATION. In most plants one man in a 40 or 44-hour week can do the work.
3. LONG LIFE—longer than the life of the bonds issued to pay for them.
4. GOOD RESULTS—top notch effluent—say 20 ppm BOD, day after day, year after year.
5. RELIABILITY distinguishes their performance always.
6. OVERLOAD IS NO PROBLEM. Take temporary shock loads—or those of a new industry right in their stride.

Plus These Further Important Points

Vitrified clay blocks have certain advantages which most engineers can appreciate. These include the infinite life built into vitrified clay; the resistance to acids, alkalis or other potentially harmful components; the manufacture in an adequate plant under controlled conditions and in compliance with strict specifications; and low cost. The cost of vitrified clay underdrains is such a small per cent of the cost of the filter that it pays to get only the best material.

TRICKLING FILTER



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902 Walnut St.
Kansas City 6, Mo.

POMONA
Pomona Terra-Cotta Co.
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ARMCRE
Ayer-McCarel Clay Co., Inc.
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TRANSLOT
Texas Vitrified Pipe Co.
Mineral Wells, Texas.

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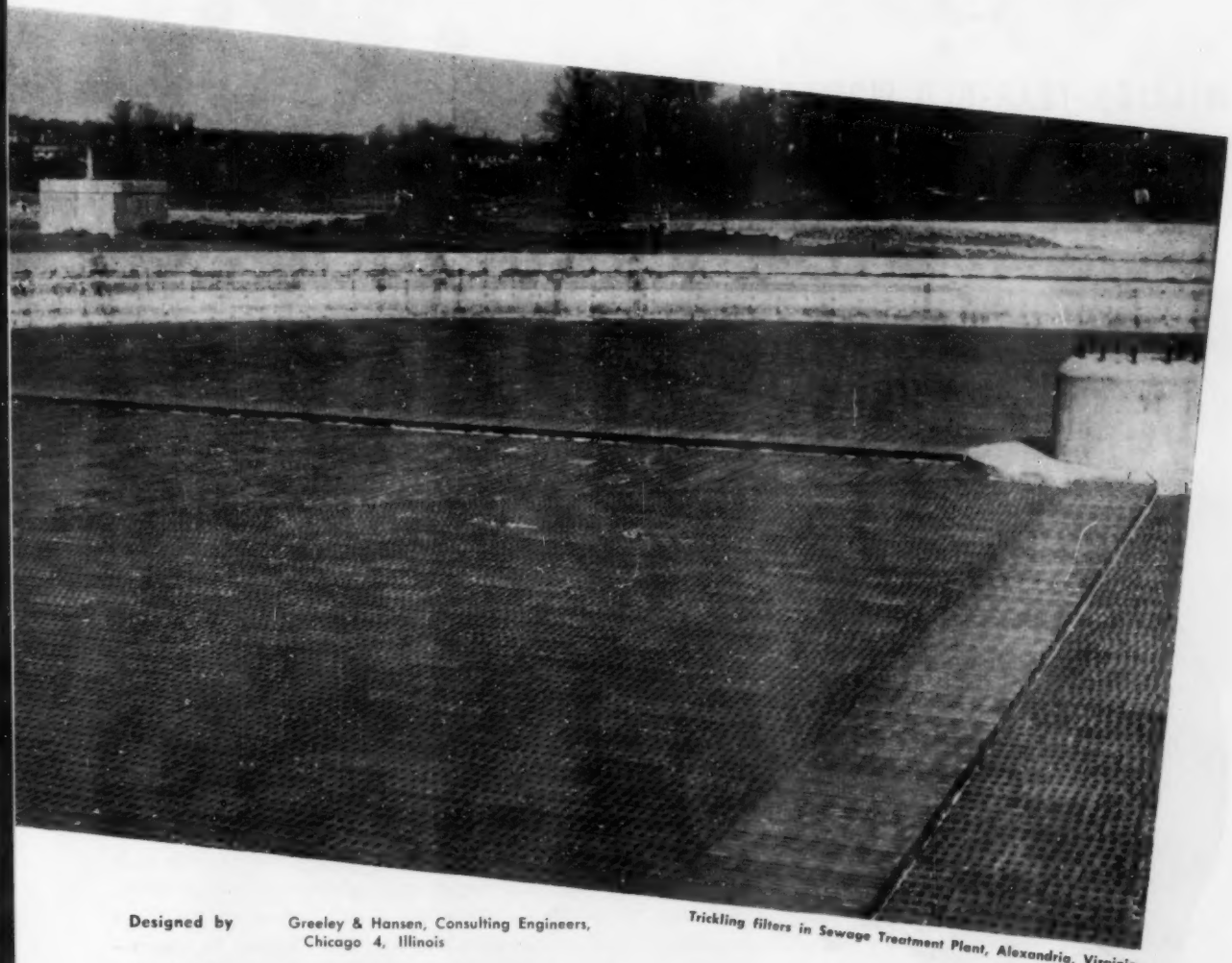


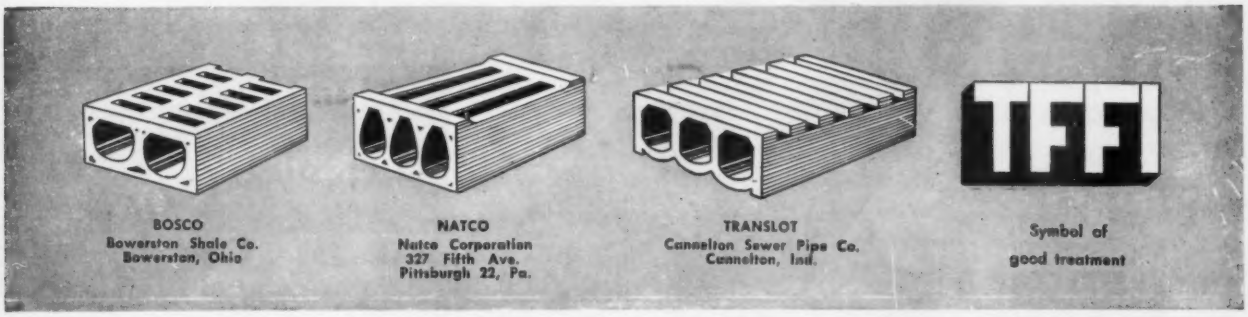
Trickling filters in Sewage Treatment Plant, Alexandria, Virginia

Designed by Greeley & Hansen, Consulting Engineers, Chicago 4, Illinois

Construction by James McHugh Construction Co., Chicago 37, Illinois

Equipment: Pumps: Worthington, Yeomans, and Marlow; Rotary Distributors, Walker Process Equipment Inc.; Gas control and heat exchanger, Pacific Flush Tank Co.; Sludge Gas Engines, C'imax Engine & Pump Mfg. Co.; Chlorinators, Wallace & Tiernan and Fischer & Porter; Digester Equipment, Dorr-Oliver Inc.

FLOOR INSTITUTE



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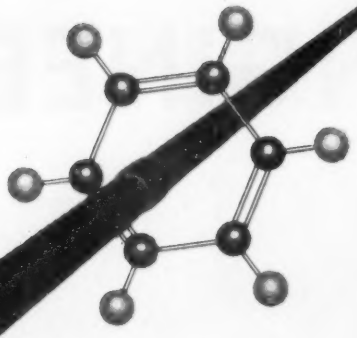

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Bituminized Fibre Pipe Exceed Federal Specifications SS-P-356

From bituminous coal, formed by Nature millions of years ago, comes *coal tar pitch*—one of the wonder chemicals of today. On all types of outdoor structures, roads, roofs—wherever successful water and corrosion resistance is a *must*—there *coal tar pitch* has proved its lasting effectiveness.

Bermico, the tough cellulose fibre pipe, for house-to-septic tank or sewer connections, is thoroughly impregnated with *coal tar pitch.*

It exceeds Federal Government performance requirements for Water Absorption—Crushing Strength—Chemical and Kerosene Resistance—Hot Water Resistance—Heat Resistance—Resistance to Flattening—Beam Strength.

That's why more and more code authorities throughout the country are including Bermico bituminized fibre pipe in their codes.

Inquire about new full-color movie: "Modern Pipe For Modern Living." Write Dept. BE-10, Brown Company, 150 Causeway St., Boston 14, Mass. (Mills: Berlin, N. H.; Corvallis, Ore.)

BERMICO®
for house to sewer or septic tank
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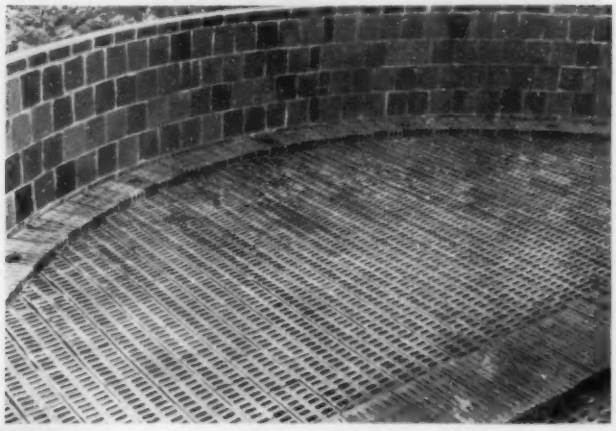
for septic tank disposal fields

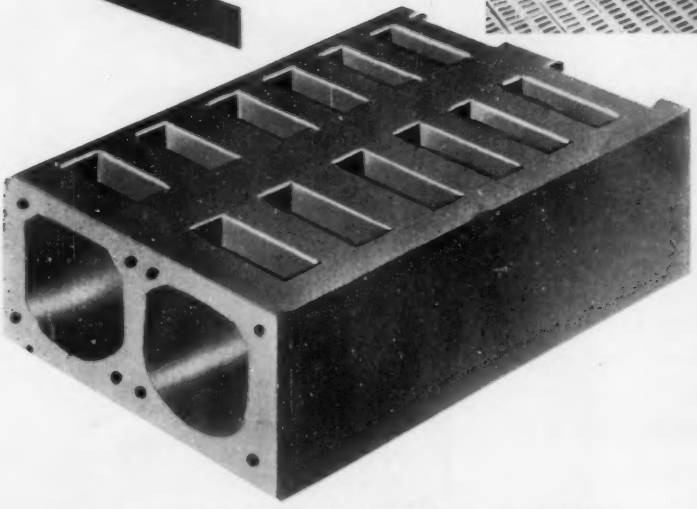
Guarantee of Quality BPI BITUMINOUS PIPE INSTITUTE

ARMCRE

trickling filter wall blocks...

ARMCRE wall tank blocks and filter floor blocks used at De Kalb, Texas





Standard ARMCRE semi-salt glazed vitrified clay filter floor block.

INFORMATION gladly furnished, with suggested specifications, for use of ARMCRE wall and filter floor blocks for trickling filters. Address:

AYER-McCAREL CLAY CO. INC.

BRAZIL, INDIANA

Facilities of Two Plants Insure Prompt Service

THE STANDARD UNDERDRAIN FOR 27 YEARS

"If it's ARMCRE you know it's the best"

These wall tank blocks (above) are full of advantages for the trickling filter designer and builder. These advantages include:

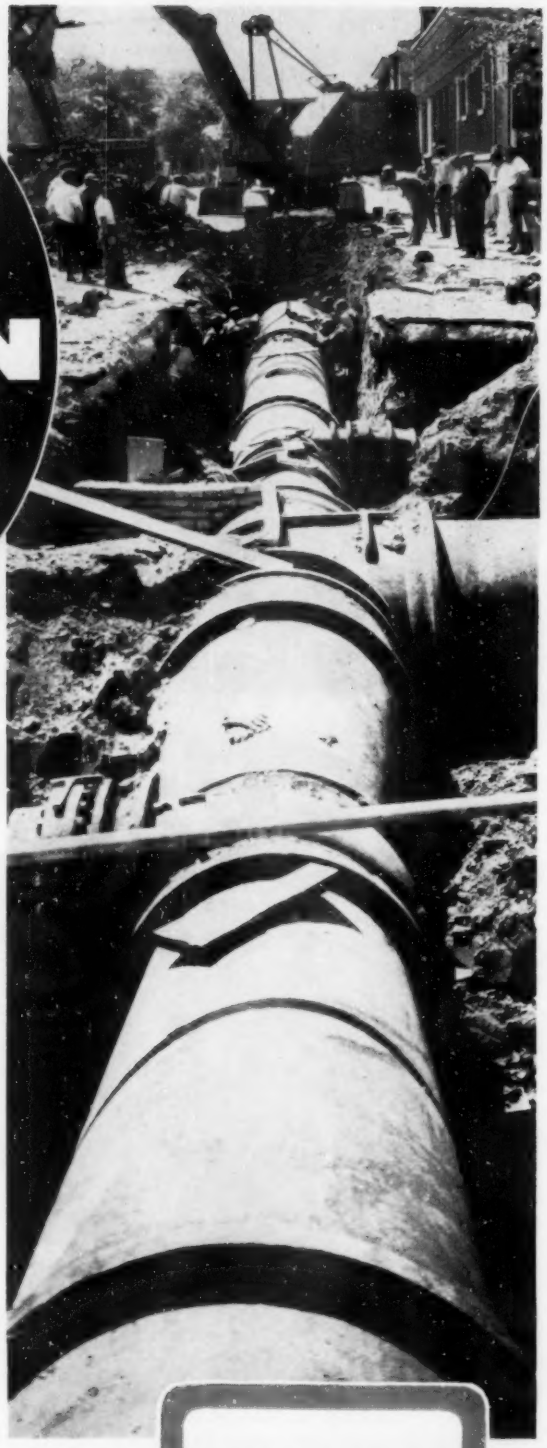
1. *A saving of 20%* on the average in construction costs.
2. *Save steel* for reinforcing other types of construction—a more costly material now.
3. *Improve appearance.* No other material gives so attractive a filter wall.
4. *Simple to use.* Low construction cost. Exact alinement. Permanency is an added feature of ARMCRE wall blocks.

● ARMCRE TRICKLING FILTER FLOOR BLOCKS

Made for both standard and high rate trickling filters. Design gives maximum flow, ventilation and capacity. Assure you of permanence and freedom from costly future trouble with your filter floors. ARMCRE gives durability where durability counts!

Why Chicago Water Costs Less...

AMERICAN CAST IRON PIPE



Delivered to the consumer at approximately 3c per ton, Chicago city water is furnished at a lower cost than that of any of the major cities of the United States.

Capable management helps keep this cost low. The 4,000 miles of cast iron pipe in Chicago's distribution system also help keep the cost low because it serves longer, with fewer replacements or repairs. For example, cast iron pipe under busy State Street, installed 105 years ago, still serves.

The American Cast Iron Pipe Company is proud to be one of the suppliers to the City of Chicago Water Department.

Include the proven long-term economy of cast iron pipe in your own plans. Your American Cast Iron Pipe Company representative will be glad to assist you.

SALES OFFICES

New York City	•	Chicago
Kansas City	•	Minneapolis
Dallas	•	Los Angeles
San Francisco	•	Orlando
Pittsburgh	•	Cleveland
Birmingham	•	Denver

AMERICAN CAST IRON PIPE CO.
BIRMINGHAM 2, ALABAMA

"We needed 40,000 ft. of trench dug as deep as 11 ft. in all kinds of weather without delay," said A. R. Palombo.
Here's why the OTTAWA BACKHOE was chosen for the Mount Joy, Pennsylvania sewer job
The A. R. Palombo Construction Company of Pittsburgh, Pennsylvania, chose the Ottawa Backhoe for their Mount Joy, Pennsylvania job, to dig 40,000 ft. of trench for 6" and 8" lateral sewer lines, many of which were 11 ft. deep.
The Ottawa patented ejector bucket, which positively ejects wet, sticky material, made it possible for them to work through all kinds of weather to complete the job. There was no costly delay due to shaking, slamming or hand cleaning, as required with buckets which do not have the automatic ejector feature.
Mr. A. R. Palombo stated, "We are also using two Ottawa Backhoes on our Bethel Boro sewage job, for several reasons. It has a powerful hydraulic action, and the two-lever control makes it easy for the operator to work in close quarters." Tight areas, trees, low wires and heavy traffic which interfere with production when using large cable type diggers are no problem with the Ottawa Backhoe.
For more information on how you can save money by using the Ottawa Backhoe with patented dual One-Trois and automatic ejector bucket, write to
OTTAWA STEEL DIVISION
L. A. Young Spring and Wire Corporation
OTTAWA, KANSAS
ANOTHER LAYCO PRODUCT
Ottawa

No Other Loader Like It!

M-B TRUCK LOADER

FAST — Exclusive hydraulically controlled jaw quickly fills ½-yd. bucket in one bite . . . Fast, 15 second loading cycle . . . Picks up big or small piles quickly and completely . . . Eliminates "back-up-and-charge" loading for the second bite. Just ease the truck ahead — the jaw does the rest.

ECONOMICAL — Gives you a complete, one-man operated load-and-haul unit . . . Releases extra personnel and tractor loaders for other jobs . . . Highest quality materials and precision manufacture assure years of dependable performance.

EASY ON TRUCKS — Husky base frame mounts *on top* of the truck chassis, evenly distributing loading and lifting forces . . . Jaw action eliminates charging the pile . . . Mounts on almost any make truck including 4-wheel drive, cab-over-engine and tilt-cab, yet stays within 96" overall width.

SAFE — Fool proof safety system on cab doors, dump body and lift rams thoroughly protect operator and complete unit . . . Operator has complete control of loader during *entire* cycle . . . Unit is amazingly strong with plenty of reserve capacity.

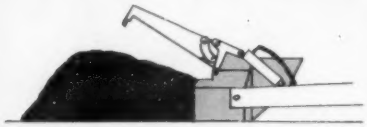
BIG SAVINGS ON MANY MUNICIPAL AND HIGHWAY JOBS

- ★ WINDROW PICK-UP
- ★ STREET REPAIR SPOIL REMOVAL
- ★ SOLO SANDER-TRUCK OPERATIONS
- ★ DISPERSED PILE PICK-UP
- ★ SCATTERED JOBS
- ★ SWEEPER PILE PICK-UP
- ★ SNOW LOADING

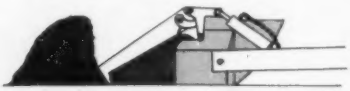
SEND FOR FACT-FILLED CATALOG TODAY!

M-B Corporation 1611 Wisconsin Ave. New Holstein, Wis.

the JAW makes the difference



M-B Truck Loader approaches material with bucket on ground, jaw raised.



Hydraulically operated jaw swings down, reaching out approximately 13" forward of the bucket lip at ground level.

Powerful jaw smoothly completes cycle, pulling in and holding a full load in the bucket.

MANUFACTURERS OF QUALITY MUNICIPAL AND CONSTRUCTION EQUIPMENT SINCE 1907

M-B CORPORATION NEW HOLSTEIN WIS

PACKER BODIES

LINE MARKERS

SWEEPERS

TRUCK LOADERS

INCREASE WATER PRESSURE

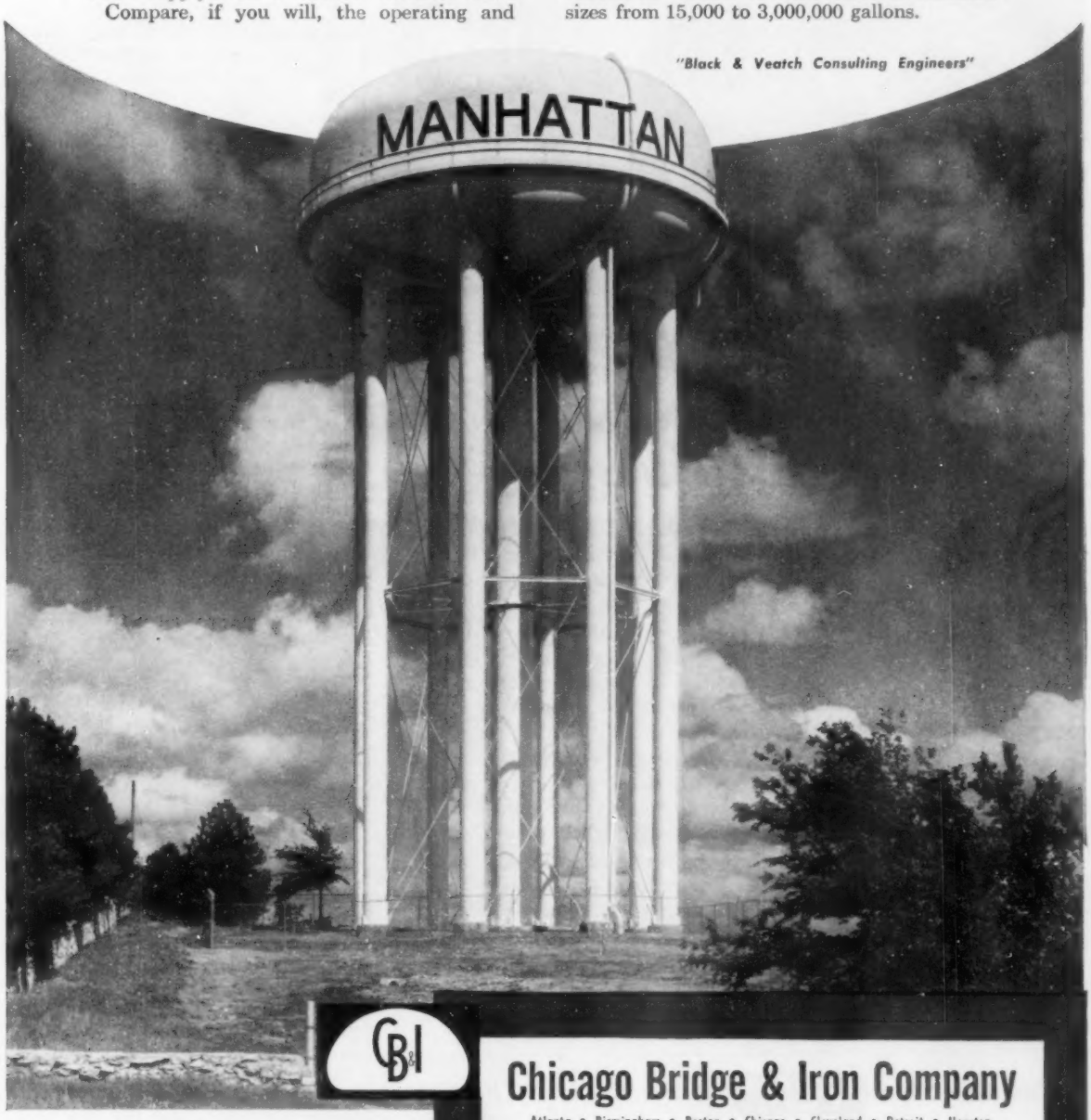
MINIMIZE PRESSURE VARIATIONS

LOWER PUMPING COSTS • MAINTAIN DEPENDABLE RESERVES

These are the primary benefits which any community can realize with a water distribution system which incorporates gravity pressure water supply with a Horton® elevated tank.

Compare, if you will, the operating and maintenance costs to your community to realize these benefits by *any other* combination of equipment. Write our nearest office for information on Horton elevated tanks in standard sizes from 15,000 to 3,000,000 gallons.

"Black & Veatch Consulting Engineers"



● This 500,000-gallon Horton® Radial Cone elevated tank and a 1,250,000-gallon ornamented standpipe were fabricated and erected by CB&I for the City of Manhattan, Kansas.

M43C

CB&I

Chicago Bridge & Iron Company

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston
Los Angeles • New York • Philadelphia • Pittsburgh • Salt Lake City
San Francisco • Seattle • Tulsa • Washington
Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PA.

Here's HYDRO-MAGIC*

HYDROHOE Moves Dirt While Traffic Moves

Here's a hoe that trenches for water lines, sewer mains or house connections, uncovers leaks, digs valve pits and handles many other dirtmoving and lifting chores on busy city streets — *without* blocking traffic.

The all-hydraulic Hydrohoe supplies more digging and lifting capacity with less weight and in less space than ordinary machines. Extremely short tail swing and standard commercial truck mounting lets it work along curbs and gutters in little more space than a parked car.

The Hydrohoe's light truck mounting lets you travel through traffic at regular truck speeds . . . up to 50 mph on the open highway. Hydraulic outriggers that extend and set in seconds provide solid stability . . . take all working stresses off the truck.

A choice of dipper sizes and types gives you unsurpassed versatility. The 20-in. utilities dipper rotates from 45 degrees behind the handle to 50 degrees ahead . . . lets you dig short, deep holes with a minimum of waste time and effort. These HYDRO-MAGIC advantages make magicians of Hydrocrane-Hydrohoe operators in situations that stump operators of ordinary machines.

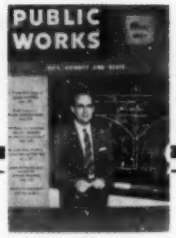
Put this fast, compact, all-hydraulic Hydrohoe on your jobs soon. Your nearby Bucyrus-Erie distributor will supply details.

204H57

A Familiar Sign BUCYRUS ERIE *at the Scene of Progress*

BUCYRUS-ERIE COMPANY • South Milwaukee, Wisconsin

* Ask your Bucyrus-Erie distributor to show you HYDRO-MAGIC — a new movie which dramatically shows the outstanding Hydrocrane advantages. Your Bucyrus-Erie distributor will be happy to arrange a showing for you.



Leader in Public Works

Kenneth W. Cosens is Associate Professor of Sanitary Engineering at The Ohio State University in the Department of Civil Engineering. He has completed 15 years as an engineering educator on the faculties of Michigan State, the University of Texas and The Ohio State University. A native of Michigan, he received his BS, MS and CE degrees from Michigan State University. In addition to teaching, his experience includes work with the City of Pontiac; stress analysis engineering with General Motors on the B-29 construction program; plant engineering and production with Oldsmobile and Buick; and bridge design engineering.

At the present time he teaches during the academic year and is associated with Burgess and Niple, Consulting Engineers of Columbus during the summers.

He is active in the AWWA at the state and national levels and the FSIWA at the state level, and has served as director of the Ohio Water Clinic for three years.

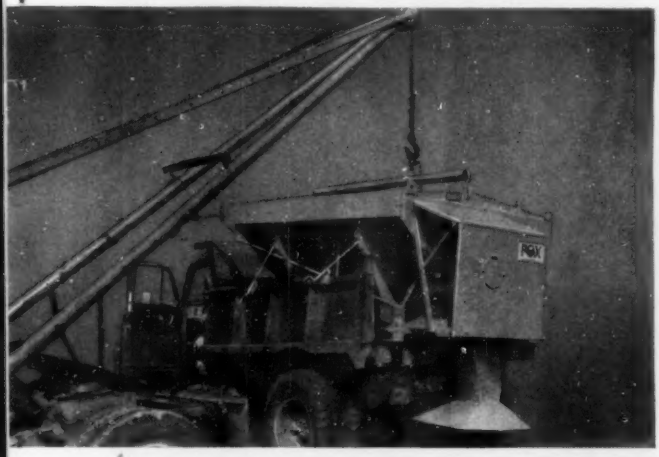
Last year he was chairman of the Sanitary Engineering Committee of the ASEE. A registered professional engineer in Michigan and Ohio, he is President of the 850-member Franklin County Chapter of the OSPE. He is a diplomate of the American Academy of Sanitary Engineers, a member of the ASCE, Tau Beta Pi, Phi Kappa Phi, Chi Epsilon, and Sigma Xi, the latter four all honorary fraternities.

Mr. Cosens is author of many articles on water, sewage, hydrology, refuse disposal, hydraulics and engineering education and prepared the article on *Operation of Sewage Treatment Plants,* which appears in this month's issue. He holds Class A Plant Operator Licenses in both water and sewerage in Ohio.

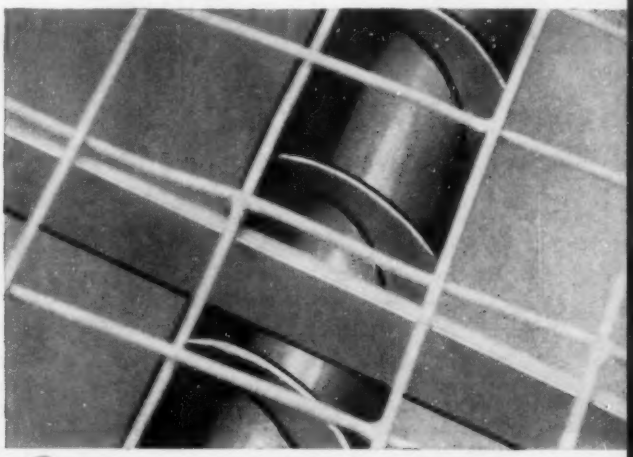
During his limited leisure time he enjoys the Hammond organ music played by Mrs. Cosens and their older son. They have two sons and two daughters ranging in ages from one to fifteen years. 35-mm color photography is his hobby. He and his family are active in the work of the Methodist Church.

FOX Mountable spreader for sand, chip, salt and calcium chloride

GIVES WINTER MAINTENANCE BUDGETS A FOUR-WAY STRETCH!



1 **Saves on truck investment.** Buy the spreader only—mount it on your dump truck. Can be mounted or dismounted in 15 minutes. Your truck can be used for other jobs as well.



2 **Eliminates costly repair time.** The *Fox Auger Feeder* has done away with chains and drag bars that wear, rust and break. *Maintenance and repair time have been practically eliminated.*

3 **One man operation.** Feed and throttle controls are easily regulated by the truck driver. There is no need of a second man to operate the *Fox Spreader. Makes manpower available for other important maintenance jobs.*

4 **Fewer trips to the stockpile.** The Fox covers nearly half again as much area with a given amount of material as most spreaders. *You make only three return trips to reload where most sanders require five.*

These are just a few of the Fox features that will help make your maintenance dollars go further. For more information, specifications, prices and a demonstration, call your nearest Fox dealer. Or if a dealer has not been appointed in your area, write or wire *Fox River Tractor Co.*, Dept. R3, P.O. Box 469—Appleton, Wis. Or phone Regent 4-1451.

FOX RIVER TRACTOR CO.
APPLETON, WISCONSIN

Fox River Tractor Co., Dept. R3
P.O. Box 469, Appleton, Wisconsin

I'm interested in stretching my street (or highway) budget. Send me complete details on the new Fox Mountable Sand Spreader.

Name_____

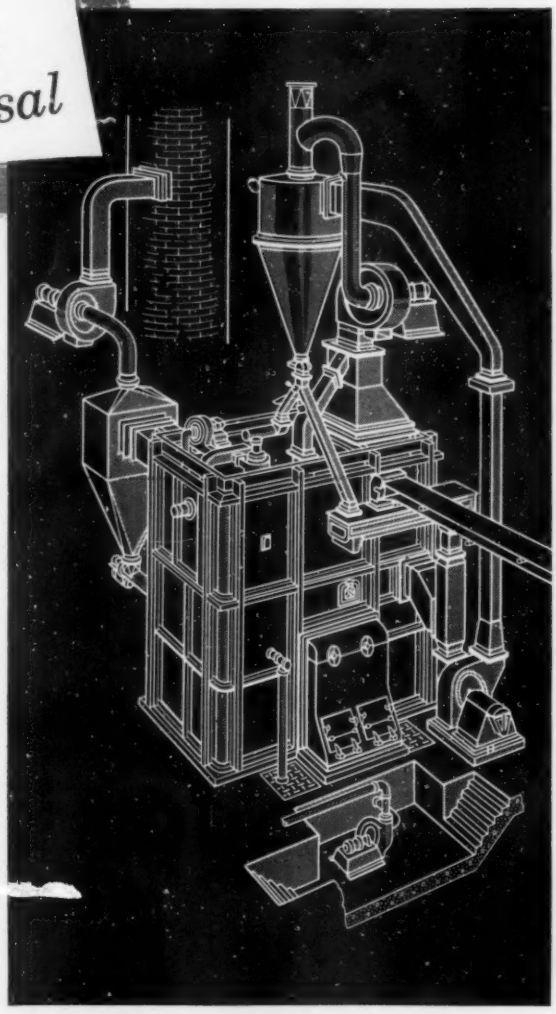
Position_____

Address_____

City_____ State_____

THE C-E RAYMOND FLASH DRYING SYSTEM...

6 reasons why it's your best choice for sludge disposal



IT OFFERS THESE FUNCTIONS:

1. Drying... Only the C-E Raymond System gives you *controlled* drying. This means that your filter cake is reduced to particles uniform in size...low and uniform in moisture content...highly suitable for use as fertilizer when sludge characteristics permit.

2. Incineration... The Raymond System provides the simplest, most efficient method of sludge incineration. It produces a sterile ash that is free of clinkers...requires less purchased fuel.

3. Deodorizing... The C-E Raymond System is the only one that offers high temperature deodorization to remove foul odors from combustion gases, as well as from sludge holding tanks.

WITH THESE FEATURES:

4. Superior Structure... Instead of relying on multiple refractory arches, the C-E Raymond System utilizes small groups of arch bricks individually hung from steel supports above and outside the furnace. This not only makes arch failure virtually impossible, but permits very rapid start-ups and shut-downs... offering important man-hour and fuel savings.

5. Economical Operation... This system has a proved record of low maintenance costs. Not only is maintenance negligible, but the revenue gained from the sale of flash-dried sludge as fertilizer can help pay the operating costs of your plant.

6. Proved Dependability... More than a quarter of a century of use and development in plants throughout the United States and abroad has shown the capability of the C-E Flash Drying System.

More filter cake is dried and/or burned in this system than by all other systems combined.

For detailed information on the C-E Raymond Flash Drying System, and how it can benefit your community, contact the Combustion office nearest you. A C-E specialist will be glad to discuss your requirements with you or your consultants.

COMBUSTION ENGINEERING

RAYMOND DIVISION, 1315 North Branch Street, Chicago 22, Illinois

Eastern Office: 200 Madison Avenue, New York 16, N. Y. • Western Office: 510 West Sixth Street, Los Angeles 14, Cal.

Canada: Combustion Engineering-Superheater Ltd.

C-E

C-107

ALSO FLASH DRYING AND INCINERATION SYSTEMS FOR INDUSTRIAL WASTE DISPOSAL

HERE'S ASSURANCE

that your concrete pipe is the strongest possible!

ANY CONCRETE PIPE that is reinforced with welded wire fabric is going to be stronger, more permanent, and easier to maintain than non-reinforced pipe.

BUT TO BE SURE of the *maximum possible* benefits from reinforcement, see that your pipe is reinforced with USS AMERICAN WELDED WIRE FABRIC. American Welded Wire Fabric is precision-made from quality cold-drawn steel wires. The quality of the steel . . . the dependability of the welds . . . the accuracy of wire spacing are all closely controlled to assure you of top performance.

You can get USS American Welded Wire Fabric in the right size and style for any type of sewer or culvert. It comes in circumferential wire sizes up to ½" at 2", 3", and 4" on centers. Write or call for complete information.

REMEMBER, IT PAYS TO ASK

"is it Reinforced"

AMERICAN STEEL & WIRE DIVISION
United States Steel
General Offices: Cleveland, Ohio

Columbia-Geneva Steel Division,
San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division,
Fairfield, Ala., Southern Distributors
United States Steel Export Company, New York

USS

UNITED STATES STEEL

simplicity

"IT'S SHORE WONDERFUL . . . EVEN
COUSIN FOOLEY KIN PUT IT TOGETHER."

U.S. cast iron PIPE

FOR WATER, SEWERAGE AND

Earle Vinnedge, Worthington Corp., and Lou Motz, Pumping Station Supervisor, Cincinnati Main Pumping Station, check performance of Worthington

itself

Our new "Tyton Joint" pipe assembles so easily even an inexperienced crew can master the technique quickly.

Only one accessory needed...a specially designed rubber gasket which seats in the bell. The entering pipe slides into place easily, compressing the gasket... making a tight, permanent seal.

No bell holes needed. What's more, "Tyton Joint" doesn't mind wet feet. You can lay it in the rain if need be!

Like to know more about this revolutionary, new pipe joint that saves time and trouble in the trench...and money on your contract?

Write or call today for the facts on "Tyton."

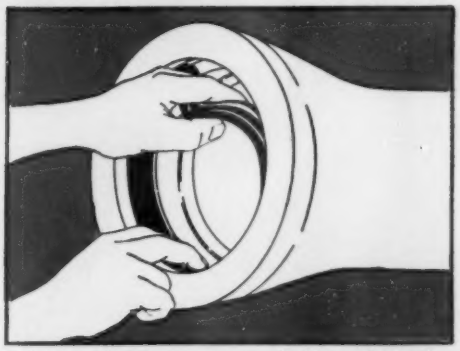
U. S. PIPE AND FOUNDRY COMPANY
General Office: Birmingham 2, Alabama

A WHOLLY INTEGRATED PRODUCER FROM MINES AND BLAST FURNACES TO FINISHED PIPE

INDUSTRIAL SERVICE CAST IRON

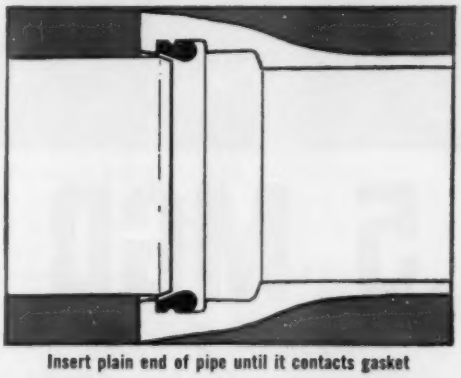
U. S. TYTON JOINT

ONLY FOUR SIMPLE ACTIONS

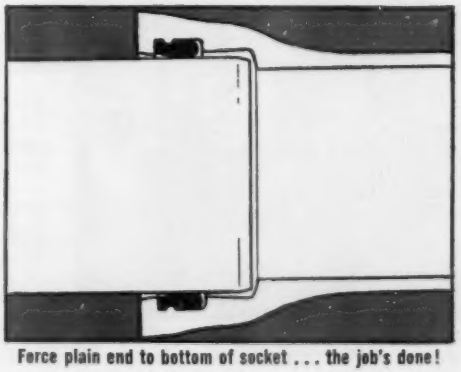


Insert gasket with groove over bead in gasket seat

Wipe a film of special lubricant over inside of gasket



Insert plain end of pipe until it contacts gasket



Force plain end to bottom of socket . . . the job's done!

Earle Vinpedge, Worthington Corp., and Lou Motz, Pumping Station Supervisor, Cincinnati Main Pumping Station, check performance of Worthington pumps installed in 1957. Earle represented one contact—one responsibility for the pumping equipment. We believe you too will find it advantageous to deal with the Man from Worthington. Cincinnati Water Works, Main Pumping Station. Consultants: Black and Veatch, Kansas City, Mo.

.5 MGD TO 500 MGD

Any size, you have more to choose from with Worthington

These Freflo sewage pumps typify hundreds of Worthington equipped treatment plants.

You benefit two ways when you deal with Worthington – world's leading builder of public works equipment.

An unbiased recommendation. Because Worthington makes all types of pumps and drives and a complete line of engines, compressors, comminutors and auxiliary equipment, you get equipment recommendations based on a broad look at all ways of doing the job. You have a choice, for example, of either vertical or horizontal centrifugal pumps. In many other ways – some small, some major – the Worthington line lets you tailor the equipment to the specific requirements of your plant.

Unit responsibility. You do business with one company—eliminating delays and inconvenience that can occur when you are forced to coordinate the efforts of several suppliers. Unit responsibility by Worthington saves you time and money.

Small or large, you'll do better by consulting Worthington. For more information call your nearest Worthington District Office. Or write to Section W-71, Worthington Corporation, Harrison, N. J.

WORTHINGTON

SEE US AT THE SEWAGE SHOW, HOTEL STATLER, BOSTON, MASS., OCTOBER 7-10, BOOTH NO. 68

IT'S NEW / It's from DORR-OLIVER

Close up view of new Degritting Chamber (left center) installed in a Dorr Clarigester at the Garden City, Idaho, Sewage Treatment Plant. Other D-O equipment at Garden City includes a 35' dia. S-7 Clarifier, a 50' dia. KCB Distributor and a 3 VM Pump.

A DEGRITTING CLARIFIER

A new two-in-one unit for small sewage treatment plants, the Dorr Degritting Clarifier or Clarigester combines positive mechanical degritting with conventional clarification in a single tank. Applicable for maximum flows of 0.45 to 1.75 MGD, this new design incorporates an annual chamber around the Clarifier feed well.

As Clarifier feed enters the chamber, grit settles and is removed by rakes attached to the Clarifier skimming arm. Overflow from the grit chamber discharges over a weir into the feed well. A by-pass slide gate allows discharge of the feed directly into the Clarifier when desired.

This new design is equally adaptable to both Dorr Type 'A' Clarifiers and Dorr Clarigesters. In either case, it will remove troublesome grit from the raw sewage without the need for costly, separate grit handling facilities.

For more complete information on this new two-in-one unit write Dorr-Oliver Incorporated, Barry Place, Stamford, Connecticut.

DORR-OLIVER
INCORPORATED
WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT
STAMFORD • CONNECTICUT • U.S.A.

Here At Last... A superior flexible plastic pipe!

ORANGEBURG®
SP Plastic Pipe

Slit-Proof... Does Not Pin-Hole

Takes Higher Pressures

Has Greater Strength

ORANGEBURG SP is the only flexible plastic pipe, made from a superior new-type polyethylene resin, which took ten years of research to perfect. This resin's extremely high molecular weight gives exceptional strength and service life... *superior qualities found only in Orangeburg SP Plastic Pipe.*

PROVED SUPERIORITY—Exhaustive tests prove ORANGEBURG SP Pipe is completely slit-proof—free from "pin-holing"! Exceeds every test known for polyethylene pipe! Does not crack, break or corrode. Defies rough handling, hot sun and freezing temperatures. Super-smooth bore increases flow capacity, prevents build-up of pressure reducing deposits.

IDEALLY SUITED FOR water service lines, jet wells, irrigation lines, underground sprinkler systems, swimming pools, water and drainage lines during construction, chemical process lines—and many other installations.

SPECIFY ORANGEBURG SP—made in ½" to 2" sizes. Weighs only ⅛ as much as steel, installs fast and at low cost. Opens new uses for flexible plastic pipe... at substantial savings. Write Dept. PW-107 for more facts.

ADVANTAGES

- Slit-Proof (No "Pin-Holing")
- Greater Strength
- Higher Heat Resistance
- Resists Acids, Alkalies, Salts
- Exceptional Resistance to Kinking
- Unaffected by Detergents or Soap Solutions
- Light, Flexible, Easily Handled
- Lengths to 400', Fewer Fittings
- Low Installed Cost, Lasting Service

APPROVED FOR DRINKING WATER SERVICE BY NATIONAL SANITATION FOUNDATION

Backed by ORANGEBURG'S 64 year reputation for quality

ORANGEBURG MANUFACTURING CO., INC. • Orangeburg, N. Y. • Newark, Calif.

MUELLER

tapping machines

give accurate alignment

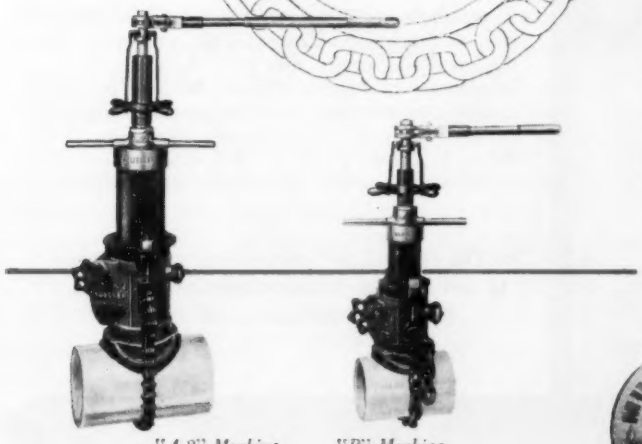
for *simple, trouble-free operation!*

Use a tapping machine with only *one* boring bar and guarantee accurate alignment, assure uniformly tapped hole and eliminate possibility of cross-threading your corporation stops.

Mueller "A-2" and "B" Tapping Machines drill and tap the main in a single operation. The combined drill and tap tool is then replaced—on the same boring bar—with the corporation stop to be inserted. Alignment is automatic and stop is inserted quickly and efficiently!

Difficulties, such as a defective thread or a tool or stop of the wrong size, are easily overcome with Mueller Tapping Machines. A flop valve between the two pressure chambers permits the boring bar and upper portion of the machine to be removed at any time during the drilling and tapping or inserting operations.

Contact your Mueller Representative, refer to your Mueller Catalog W-96 or write direct today.



"A-2" Machine inserts or removes corporation stops 1" to 2" pipe plugs 1" to 4"

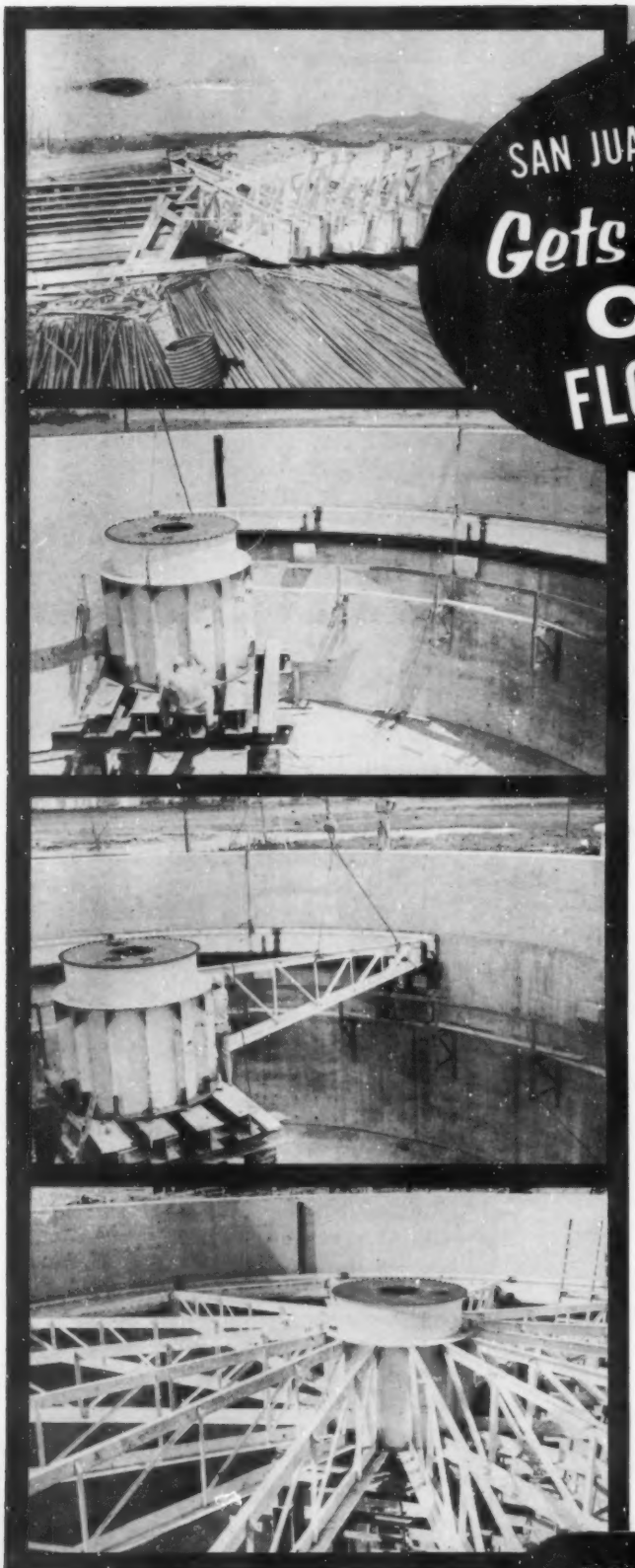
"B" Machine inserts or removes corporation stops ½" to 1" pipe plugs ½" to 2½"

MUELLER CO.

DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles; In Canada: Mueller, Limited, Sarnia, Ontario

Since 1857



BIG NEW SAN JUAN, PUERTO RICO PLANT Gets Four 70'-0" CARTER FLOATING COVERS

Here is a typical example of excellent design and accurate construction in Floating Covers that wins the praise of Engineers and Field Men everywhere. The Carter unit shown here—one of four 70'-0" Carter Covers going into the new San Juan, Puerto Rico Sewage Treatment Plant—clearly demonstrates the skillful planning and precision workmanship that went into its manufacture. Carefully laid-out and stress analyzed . . . then preassembled and match-marked at the factory . . . this unit, like all Carter Floating Covers, assures swift troublefree erection in the field—and excellent operation in the plant.

Add to this, the Carter Heat Exchanger with its exclusive system of jacketed piping. Here's a heating system acclaimed, by many, as the most efficient yet devised for the temperature-sensitive digestion process. Plant Operators particularly like the freedom of arrangement between sludge tubes and boiler . . . giving maximum convenience in location and greater accessibility in cleaning.

And, of course, there's a complete line of Underwriter's Approved gas utilization equipment for any system of balanced digestion.

Engineers have discovered that among the many advantages in specifying Carter equipment is the excellent service that goes with it. These men know that every Carter sludge digestion system includes not only the finest in equipment of its type . . . but also an interest by the Ralph B. Carter Company that extends beyond the sale to successful installation and operation.

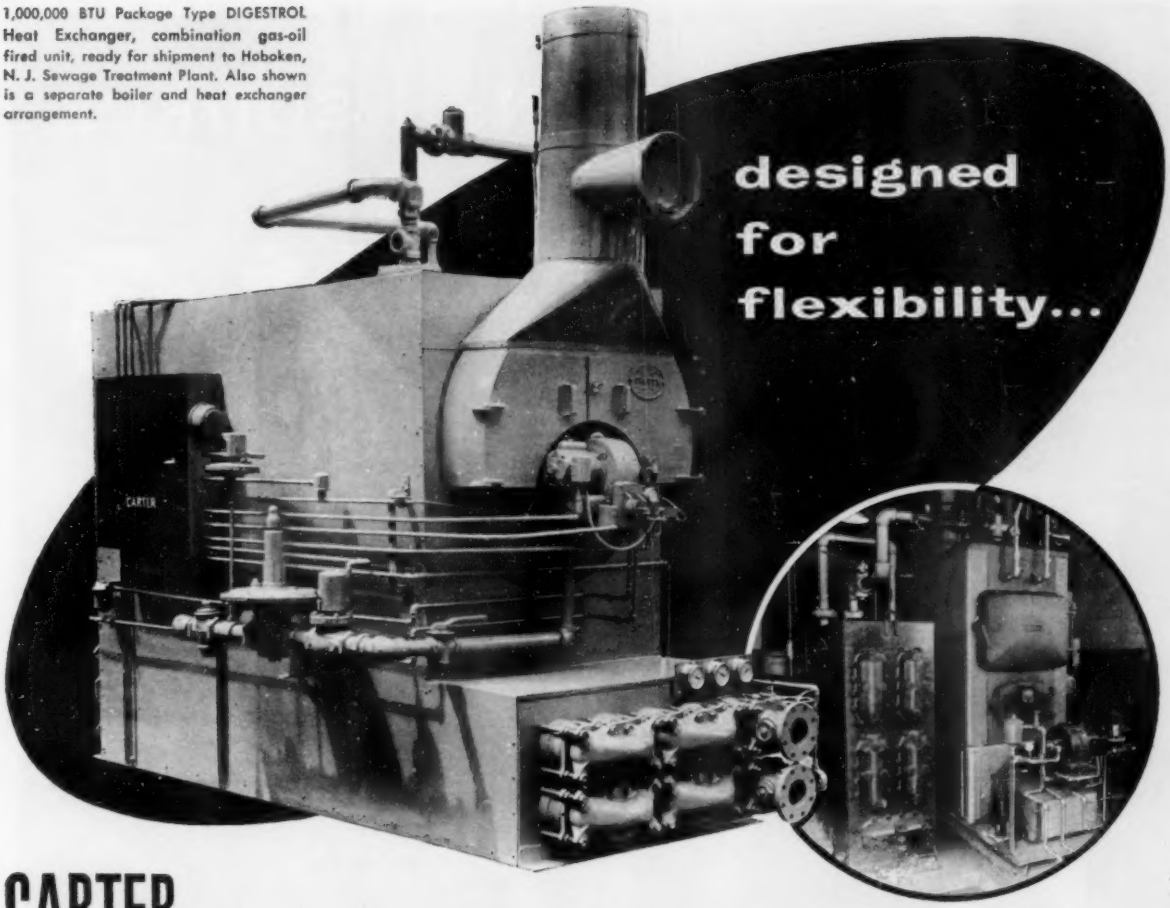
WRITE TODAY for information or assistance in solving your sludge digestion problems. There's no obligation, of course.

Consulting Engineers:
Buck, Seifert & Jost
New York City, N. Y.

General Contractor:
Raymond Concrete Pile Co.
New York City, N. Y.

RALPH B. CARTER COMPANY
210 ATLANTIC STREET, HACKENSACK, NEW JERSEY

1,000,000 BTU Package Type DIGESTROL Heat Exchanger, combination gas-oil fired unit, ready for shipment to Hoboken, N. J. Sewage Treatment Plant. Also shown is a separate boiler and heat exchanger arrangement.



CARTER *digestrol* HEAT EXCHANGERS

Here's a sludge heating system acclaimed by many as the most practical and efficient yet devised for the temperature-sensitive digestion process. Boiler and heat exchanger are two independent units combined in a single, compact package . . . or can be furnished separately where required. The flexibility and complete operational freedom provided by this arrangement permits sludge tubes and boiler to be operated at different temperatures . . . and allows the selection of a boiler* of any capacity where building heat requirements must be met, in addition to heat exchanger demands.

*All boilers are ASME stamped.

Carter's efficient tube-within-a-tube heat exchanger design consists of a 4" sludge tube within a 6" water-jacket . . . with flow of hot water countercurrent to sludge flow. This highly effective design requires approximately 1/2 less external sludge tube area than does an equivalent immersion bath system . . . and is readily adaptable to an existing boiler or other hot water source. Units are designed for the utilization of sewage gas, manufactured gas, oil, or automatically controlled combinations of these fuels. Carter can also furnish a complete line of Underwriters' Approved gas utilization equipment for any system of balanced digestion.

Ralph B. Carter Company 210 ATLANTIC STREET HACKENSACK, NEW JERSEY

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for dependable pipe line equipment

Like hundreds of Pollard customers, you'll find it mighty pleasant and convenient to order pipe line equipment from Pollard.

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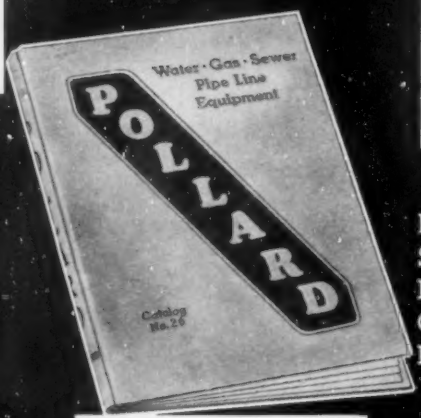

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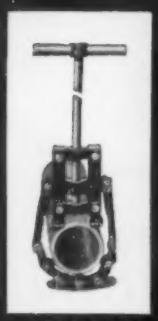

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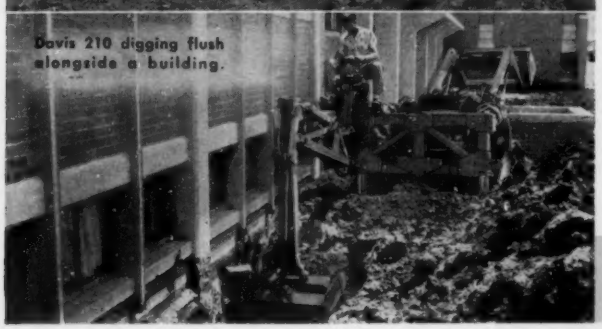
Davis Model 210 Backhoe and 102 Loader on a Model 202 Work-Bull Tractor.



Davis 210 digging flush alongside a building.

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— it's the greatest LOADER-BACKHOE at any price . . . on any tractor*!

Only the Davis Loader-Backhoe allows you unrestricted vision. You can see why this rig, with many such exclusive features gives you more earning power.

You sit high on the backhoe so you can see exactly where you're working and you move with the boom so you always face the bucket — just like on the big power shovels.

Only the Davis 210 Backhoe lets you dig flush alongside a building, wall, or fence. Vertical stabilizers, right-angle digging, and 10,000 pounds breakaway power give you the advantage on every job.

The Davis Loader — with built-in strength and streamlined design — has been widely copied, but never equalled.
You would naturally think that this rig would cost you more, but it actually costs less than most other makes.

*Davis Loaders and Backhoes are available for all popular models of International, Ford, Work-Bull, Ferguson Major, Ferguson, Case, Massey-Harris, Allis-Chalmers, Oliver, John Deere, and Minneapolis-Moline Tractors.

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Stationary Diesels For Water and Sewage Plants

28. Engines are four-cycle, 6 or 8 cylinder, in-line models, ranging from 530 to 2,000 bhp and from 300 to 1,250 KW, are available either naturally aspirated or supercharged, and can be furnished to run as diesel, dual-fuel or gas engines. For Bulletin #110 check the reply card or write White Diesel Engine Div., The White Motor Co., Springfield, Ohio.

Highway Signs Made of Fir Plywood

40. Specification and procurement, design data, case histories and reference data of fir plywood signs are the sections covered in this file of Bulletins available from the Douglas Fir Plywood Association, Tacoma 2, Wash. Check the reply card.

Gradall Pocket-Sized Reference Manual

114. This manual contains drawings portraying all Gradall dimensions and specifications and a well-rounded selection of photographs of the various Gradall models at work on actual jobs of all descriptions. Covered are the truck - mounted, crawler - mounted, self-propelled and railroad model Gradalls. Check the reply card or write the Gradall Div., The Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio, for your copy today.

Automatic Engine Control Equipment Manual

83. This catalog contains descriptions of standard automatic and semi-automatic controls and control equipment. General control recommendations, control selection chart, accessory selection chart, safety stop controls and alarm sets are sections covered. For price lists and models available write Synchro-Start Products, Inc., 8151 N. Ridgeway, Skokie, Ill., or check the reply card.

Design Manual on Complete Structural Systems

100. Manual contains technical information relative to Stran-Steels line of joists, studs, channels, ribbed decking and metal curtain walls. It is well illustrated and contains several pages of loading tables. For this valuable Manual write Stran-Steel Corp., Detroit 29, Mich., or check the reply card today.

Design of Prestressed Concrete Tanks

194. An 8-page technical Bulletin, T-19, on the Design of Prestressed Concrete Tanks, gives engineering data and formulas of general interest to anyone considering prestressed concrete for storage tanks. Check the reply card or write The Preload Co., Inc., 21 East 37th St., New York 16, N. Y.

Valuable Information on Concrete Testers

210. Concrete compression testers and flexure testing machines, portable concrete testers, and testing machines for concrete, clay and tile pipe are described fully in Bulletins from Forney's Inc., Tester Div., P. O. Box 310, New Castle, Pa. Check the reply card for complete information on models and specifications.

Cylindrical Mechanically Stoked Municipal Incinerators

278. Bulletin No. 111-C from the Morse Boulger Destructor Co., New York 11, N. Y., describes fully the mechanically stoked incinerator, as well as giving a typical installation list, and also shows a typical layout of a single unit plant, and a two unit plant. Check the reply card.

Carball Units Designed To Supply CO_2

338. Bulletin 7W88 describes small series Carball units that are designed specifically to supply CO_2 for small treatment plants. Typical installations, drawings and specifications are covered in literature available from Walker Process Equipment Inc., Aurora, Ill. Check the reply card.

Electronic Measuring Device For Survey Crews

339. The Tellurometer system of distance measurement operates on radio microwaves of 10 cm. wavelength. Two instruments are needed with a duplex telephone provided as an integral part of the system. For full information write Tellurometer, Inc., 1346 Conn. Ave., N. W., Washington 6, D. C., or check the reply card.

Data on Vertical Non-Clog Pumps

501. A two color catalog describing two types of vertical non-clog pumps is available from C. H. Wheeler Mfg. Co., Economy Pump Div., 19th and Lehigh Ave., Philadelphia 32, Pa. Check the reply card for performance data, size information and dry pit installations.

New Method For Removing Grit From Sewage and Sludge

504. DorrClone Classifier for degritting sewage is described fully in Bulletin No. 2508 available from Dorr-Oliver Inc., Barry Place, Stamford, Conn. Check the reply card for arrangements and applications.

Data on Shovels, Hoes, Cranes, Clamshells and Draglines

56. A 20-page illustrated catalog featuring the Bay City 1 yard, 25-ton capacity crawler crane contains facts and photographs, describing economy and efficiency features of this convertible shovel hoe, crane, clamshell and dragline. Check the reply card or write Bay City Shovels, Inc., Bay City, Michigan, for your copy.

Manual on Bronze and Iron Body Valves

99. A 136-page Manual, No. 57, covering complete line of bronze and iron body valves is available from the Fairbanks Co., Catalog Dept., 393 Lafayette St., New York 3, N. Y. Check the reply card for helpful technical data for the initial design of piping layouts and other information.

Calculator For Selecting Flow Meter For a Specific Job

156. A calculator for aiding users of Brooks rotameters in selecting the appropriate meter for a specific application is available from Brooks Rotameter Co., Lansdale, Pa. Covered are the pressure and temperature limitations of Brooks rotameters as well as their flow capacity ranges. Check the reply card today.

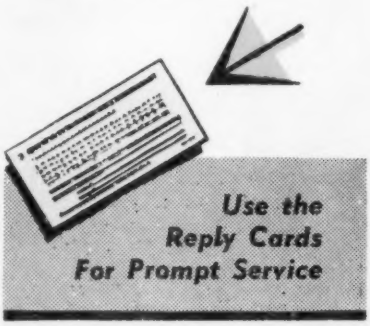
MORE LISTINGS ON PAGES 36 TO 52

Complete Information on a Bituminous Paver-Finisher

200. A 12-page Bulletin describing the PF-90 bituminous paver-finisher is now available from Construction Equipment Div., Blaw-Knox Co., Mattoon, Ill. Various application possibilities and general specifications of the paver-finisher are covered.

Performance and Design Features of A-C Motor Scraper

447. An 8-page illustrated catalog (MS-1226) on the Allis-Chalmers TS-160 motor scraper is available from the Allis-Chalmers Mfg. Co., Tractor Group, Milwaukee, Wisc. Photographs, illustrations and specifications help tell the unit's design and construction story. Check the reply card.



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Pacific Northwest Section, SIWA
Seattle, Wash., Oct. 24-26

New Jersey Section, AWWA
Atlantic City, N. J., Oct. 24-26

California Section, AWWA
San Jose, Calif., Oct. 29-Nov. 1

Chesapeake Section, AWWA
Washington, D. C., Oct. 30-Nov 1

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Roanoke, Va., Nov. 6-8

Nebraska Section, SIWA
Hastings, Nebr., Nov. 7-8

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Miami Beach, Fla., Nov. 10-13

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Cleveland, Ohio, Nov. 11-15

South Carolina Section, SIWA
Columbia, S. C., Nov. 15

Oklahoma Section, SIWA
Water & Sewage Short Course
Stillwater, Okla., Nov. 18-22

Exposition of Chemical Industries
New York, N. Y., Dec. 2-6

New York Section, SIWA
New York, N. Y., Jan. 23-24, 1958

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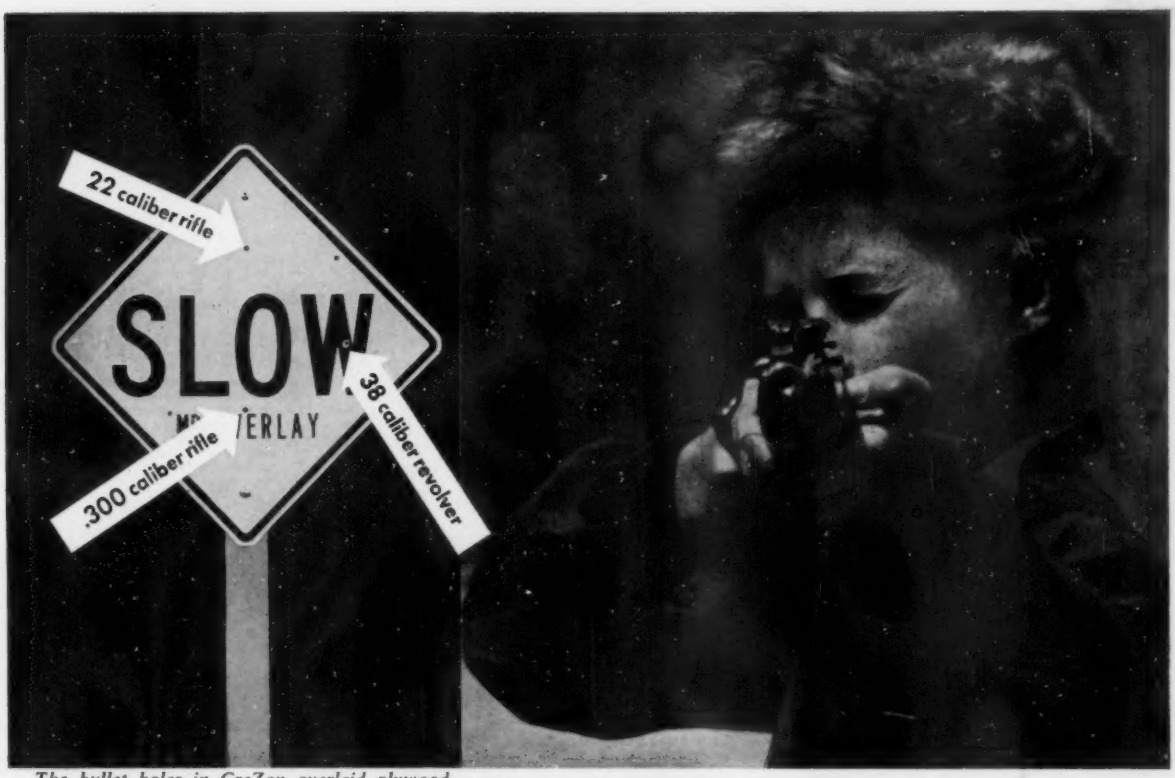


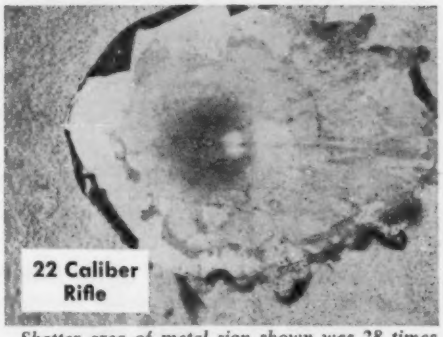
The bullet holes in CreZon overlaid plywood are scarcely visible, tend to seal themselves.

A SIGN THAT REFUSES TO SAY "I'M DEAD"

● To frustrate the "sign hunters", more and more highway sign users are adopting CreZon overlaid plywood signs. These new-type signs don't resound, don't show gaping holes. And the bullet holes remain small, even tend to fill in, thus sealing themselves.

Weather tests prove that CreZon plywood signs have an actual life expectancy of up to 15 years. The material is strong and rigid; resists bending or tearing loose from pole. There's neither checking nor blistering from heat or freezes. And water won't seep in behind its weather-proof surface.

CreZon plywood is easy to work, too. Its velvet-smooth tooth takes paint extremely well, assures greater visibility, higher gloss. You cut costs in many ways with this ideal sign material.



Shatter area of metal sign shown was 28 times larger than in CreZon plywood also struck by a 22 calibre bullet.

CreZon plywood is available through these plywood manufacturers and their distributors. Consult your Yellow Pages for company nearest you or write Dept. CR, Crown Zellerbach, 343 Sansome St., San Francisco 19, California.

Diamond Lumber Company
Portland, Oregon

Georgia Pacific Corp.
Portland, Oregon

Edward Hines Lumber Co.
Chicago 2, Illinois

Mount Baker Plywood, Inc.
Bellingham, Washington

Roseburg Lumber Company
Roseburg, Oregon

St. Paul & Tacoma Lumber Co.
Tacoma, Washington

United States Plywood Corp.
New York 36, New York

Walton Plywood Company
Everett, Washington

Also available in Canada through:

Canadian Western Lumber Co.
New Westminster, B. C.

MacMillan & Bloedel, Ltd.
Vancouver 1, B. C.

Western Plywood Co., Ltd.
Vancouver 15, B. C.

The permanent protective overlay for plywood.

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CROWN ZELLERBACH
SAN FRANCISCO 19, CALIFORNIA

To order these helpful booklets check the reply card opposite page 34.

Blower Selection Data Aids Sewage Plant Design

724. Characteristic curves for blower operation with constant-speed, multi-speed and variable speed motors; details of several types of blowers; data on accessories; and a discussion of advantages of positive displacement rotary blowers are provided in Bulletin RB 154 of Roots-Connersville Blower Div., Connersville, Ind.

Sewer Capacity Speedily Restored By "Reboring" Service

725. An attractive brochure offered by National Power Rodding Corp., describes their mobile unit with specially designed power rodding drive and central mechanism that gets on the job fast; rebores clogged sewers and drains cleanly and safely without impeding traffic or disturbing property. National Power Rodding Corp., 201 N. Wells St., Chicago 44, Il.

Chemical to Control Sewage Odors

726. Cloroben is a sanitation chemical that provides control of sewage odors in treatment plants, septic tanks, cesspools and chemical toilets. Write Cloroben Chemical Corp., 115 Jacobus Ave., South Kearney, N. J., or check the reply card for applications and performance data.

Manual on Fusion Welded Steel Pipe For Water

727. Technical information, pictorial descriptions, price lists, manufacturing and field installation specifications and engineering data are covered in this Manual. Check the reply card or write Southern Pipe & Casing Co., Div. of U. S. Industries, Inc., Box C, Azusa, Calif., for data on steel pipe from 4" to 48" and fittings.

Data on the "Over-Cab" Snow Loader

728. Unit can permit single or double lane loading with trucks traveling in either direction and the 16-ft. conveyor is fully hydraulically operated. For specifications write N. P. Nelson Iron Works, Inc., 852 Bloomfield Ave., Clifton, N. J., or check the reply card.

Information on Welded Wire Fabric

729. Reinforced concrete sewer and culvert pipe that are made with U.S.S. American welded wire fabric are described in literature from American Steel & Wire Div., United States Steel, Cleveland, Ohio. Check the reply card for specifications and engineering data.

Underdrain Blocks For Trickling Filters

730. "Natco Unifilter" salt-glazed blocks for underdrains for trickling filter beds are balanced in size and weight for easy handling. Typical construction details for trickling filters of 20 to 160 ft. diameter are contained in a 16-page bulletin UF-3 from Natco Corp., 327 Fifth Ave., Pittsburgh 22, Pa. Check the reply card.

Manual on Calcium Chloride in Concrete

731. A ready reference to quantitative data on the effects of calcium chloride in concrete is available from Calcium Chloride Institute, 909 Ring Building, Washington 6, D. C. Check the reply card for this valuable Manual.

•

WATER WORKS

Ball and Socket River Crossing Cast Iron Pipe

33. Literature is available describing Clow ball and socket cast iron pipe for river crossing, or any installation where full 15 degree free turning deflection is desirable. For full description and specifications, address James B. Clow & Sons, Inc., P. O. Box 6600-A, Chicago 80, Ill., or check the reply card.

Do You Have An Independent Source of Electricity?

27. An independent source of electricity which will supply power for vital services when regular sources fail can be invaluable during emergencies. Check Kohler Bulletin KEP 56-1 which furnishes data that will help you select the plant best suited for your needs. Many models, 500 watt to 50 Kw, portable and stationary are described. Write the Kohler Co., Kohler, Wis., or use the reply card.

Elevated Tanks and Other Storage Facilities

32. Specification sheet covering elevated tank sizes and design and illustrated brochure available from the Darby Corp., Kansas City 15, Kansas.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal control of certain tastes and odors plus other aids in high quality water production. Check reply card for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

Complete Catalog on Pipe Line Equipment

121. Listed under one comprehensive catalog No. 26 are a complete line of water, gas and sewer pipe line equipment. Some of the items covered are pipe cutters, diaphragm pumps, melting furnaces, calking tools, M-scope pipe finders and joint runners. Write to Joseph G. Pollard Co., Inc., New Hyde Park, N. Y., or circle the reply card for your copy.

Helpful Booklet on Carryable Centrifugal Pumps

129. A booklet prepared to give practical information that will guide you in choosing the best type of pump for your requirements is offered by the Homelite Corp. Requirements are outlined for many applications. Check the reply card for your copy. Homelite Div. of Textron Inc., 2125 Riverdale Ave., Port Chester, N. Y.

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SAFETY CHAMPION FOR STREETS AND HIGHWAYS
choice of 4 drives

PTO with { Mechanical Operation / Hydraulic Operation

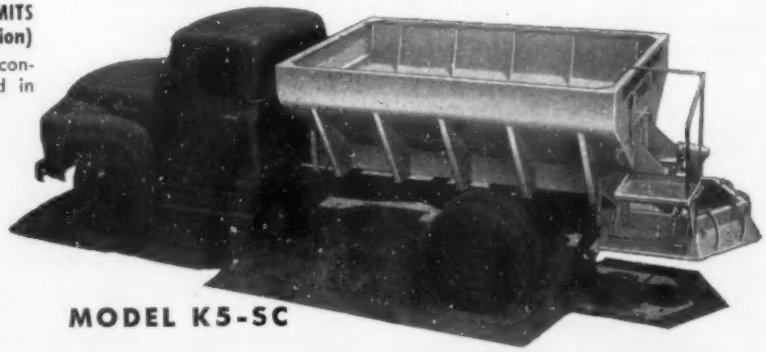
Auxiliary Engine with { Mechanical Operation / Hydraulic Operation

CAB CONTROLLED VACUUM CLUTCH PERMITS SPOT SPREADING (on mechanical operation)

Completely sealed, vacuum operation, controlled from cab. Start or stop spread in motion, as at intersections, safety zones. On hydraulic operation models, spot spreading is controlled by by-pass valve.

TWO-SPEED "QUICK CHANGE" MECHANISM

Simple sprocket and chain drive: low for chemical spreading, high for large-volume spreading. No need for expensive automotive transmission. On hydraulic opetation models, spreading volume is valve controlled.



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- **Correct Weight Distribution . . . for maximum traction and flotation**
- **Direct Electric Starting . . . 24-volt turn-key system for fast starts**

Advanced design and quality manufacturing make the TS-260 an outstanding performer on many earth-moving jobs. Its rugged construction and built-in power add up to long, dependable performance that pays off in high output.

See your Allis-Chalmers dealer for full information on the complete line of motor scrapers, motor wagons, and pull-type scrapers. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS *Engineering in Action*

To order these helpful booklets check the reply card opposite page 34.

Engineering Information and Water Distribution Products

49. Helpful engineering information, covering water distribution problems, is available from Mueller Company in their W-96 Water Works Catalog. The 328 page catalog features a quick reference sectional indexing arrangement for easy location and identification of the hundreds of water distribution and service products illustrated. Check the reply card and you will receive detailed information on a complete line of water works equipment.

Handbook of Cast Iron Pipes and Fittings

52. Full engineering data on products of the Alabama Pipe Co., including Super De-Lavaud cast iron pressure pipe and pipe fittings, valve boxes and other municipal castings are provided in Pressure Pipe Catalog No. 54, a 196-page publication of Alabama Pipe Co., Anniston, Ala. Weights, dimensions and specifications are clearly indicated in this easy to use reference. Requests for this valuable publication should be accompanied by your business letterhead.

What You Should Know About Steel Reservoirs and Standpipes

163. In a handsome 24-page booklet "Horton Steel Reservoirs and Standpipes," the Chicago Bridge & Iron Co., Chicago 4, Ill., shows installation from 50,000-gal. to 10,000,000-gal. capacity with several types of roof and special architectural features. Engineering data includes information on capacities, foundations and improved surface protection. Check the reply card to get your copy.

Review of Diatomite Filtration of Water

285. A detailed review of the application of diatomite in the general field of water filtration, including uses in municipal supply and swimming pools is contained in a well-prepared 16-page bulletin. Specific applications to certain water treatment problems are also discussed. Write to the Dicalite Division, 612 So. Flower St., Los Angeles 17, Calif. for Bulletin F-552 entitled, "Diatomite Filtration of Potable Water," or check the reply card.

Helpful Reference Catalog on Waterworks Gate Valves

146. All necessary details on Double Disc Parallel Seat Gate Valves for waterworks use are provided in the attractive 36-page bulletin issued by Ludlow Valve Mfg. Co., Inc., Troy, N. Y. Conveniently arranged design data shows all dimensions for 2" to 60" valves. Gearing, floor stands, operating devices are covered too. Get Bulletin 54W by checking the reply card.

Protective Lining for Concrete Pipe and Structures

131. T-Lock Amer-Plate is a tough, long-lasting acid-resistant vinyl sheet lining for concrete pipe and structures which are exposed to corrosive materials. T-shaped ribs pressed in the sheet are embedded in the concrete as it is poured to lock the lining permanently in place. Get full details from Amercoat Corp., South Gate, Calif., or check the reply card for illustrated folder.

Use The Reply Card

Pipe Joint Essentials and Couplings for Every Job

168. Superior pipe joints are tight, flexible, simple, strong and economical. Dresser's handsome 34-page bulletin No. 513 shows how these essentials are met and provides layouts for curves, working pressures and a wealth of other data. Be sure to check this bulletin on the coupon. Dresser Mfg. Div., 59 Fisher Ave., Bradford, Pa.

A Short Course In Pipe Jointing

169. The story of rubber couplings for clay and concrete pipelines is graphically presented in the booklet "Pipe Enterprise"', published by Hamilton Kent Mfg. Co., Kent, Ohio. Detailed description of pipe jointing methods; photos showing jobs where Tylox gaskets met the need for easily assembled permanently tight joints installed under all conditions; and a report on the development, manufacture and outstanding features of the compression type gasket make this booklet valuable to every engineer and contractor. Check the reply card.

Engineering Data On Gravity Filter Design

170. The complete line of gravity filters and related accessories furnished by the Permutit Co., New York 36, N. Y., is covered in a well-illustrated 24-page booklet. Each element of a filter and filter controls are discussed in detail to assist the designer of these important units. Check the reply card.

All-Electric Floatless Liquid Level Control

174. Description of operating principles and application of B/W controls show the simplicity and many uses of these all-electric, floatless devices. Get latest bulletins for engineering data, diagrams of typical installations and details of component parts. Check the reply card or write B/W Controller Corp., Dept. PW, Birmingham, Mich.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy.

Efficient Underdrains for Rapid Sand Filters

239. Be sure you have engineering data on vitrified clay underdrains, efficiently designed for filtering and backwashing. Check the reply card or write F. B. Leopold Co., Inc., Dept. PW., 227 So. Division St., Zelienople, Pa.

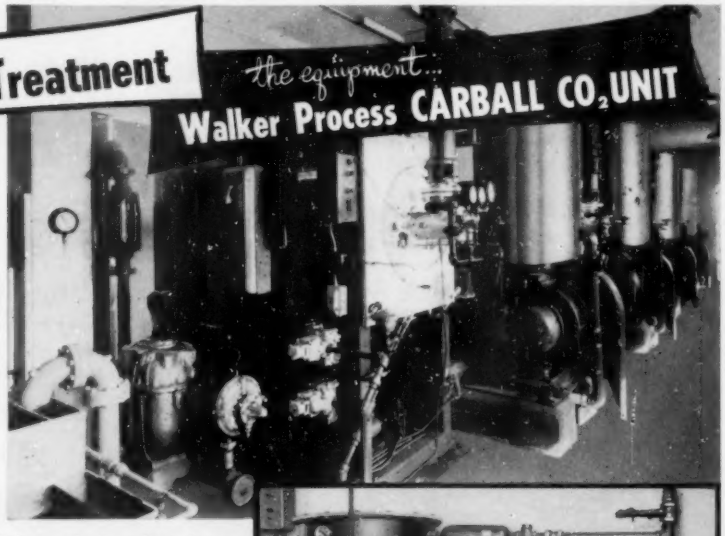
Book Tells How to Control Algae

371. Details on the control of various microscopic organisms frequently found in water supplies are furnished in a 44-page booklet offered by Phelps Dodge Refining Co., 300 Park Ave., New York 22, N. Y. Check the reply card.

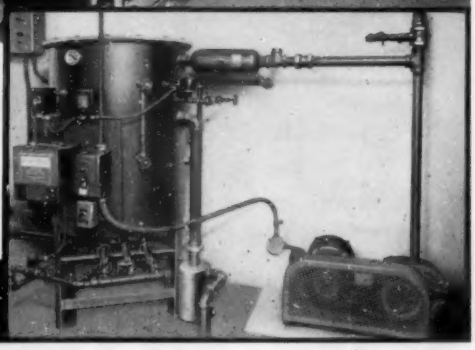
the process...
Carbonation--Water Treatment

the equipment...
Walker Process CARBALL CO_2 UNIT

CARBALL
CO_2 UNIT



Four size 4 Carballs at Kansas City, Mo. burn either gas or oil to produce max. of 40,000 lbs. CO_2/day. Size "O" unit at right produces 570 lbs. CO_2/day for Jefferson, Iowa Water Plant.



Walker Process now offers carbonation units for all lime softening plants from the very small to the largest. Sizes range from the new "OO" unit with minimum capacity of 55 lbs. CO_2/day to the No. 4 at maximum output of 10,000 lbs. CO_2/day. Engineers can readily provide an entire carbonation system by simply specifying the appropriate size CARBALL in combination with Walker Process SPARJER diffusers . . . . . assuring

100% Combustion • Economical Operation • Unique Absorption Method
50% More CO_2 • Clean, Tasteless Gas • Factory Tested Package System

Write for bulletins 7W83 - 7W85 and 7W88

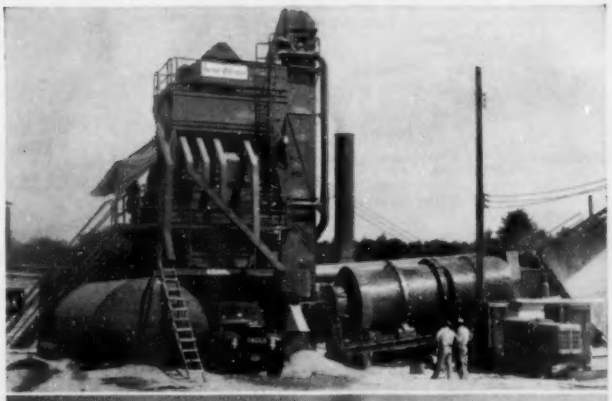
WALKER PROCESS

WALKER PROCESS EQUIPMENT, INC.
FACTORY • ENGINEERING OFFICES • LABORATORIES
AURORA ILLINOIS

Why this paving contractor bought his 4th BatchOmatic . . .

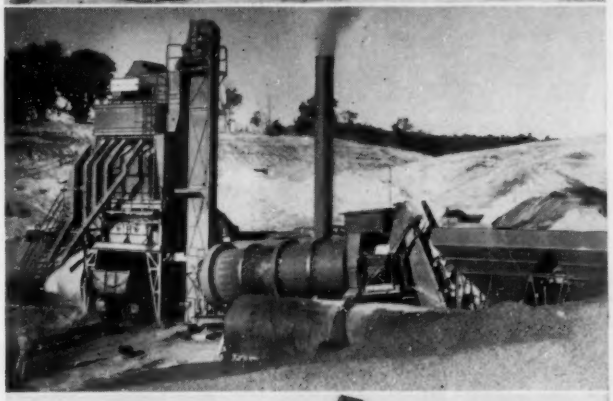
PLANT NO. 1

AUG. '55



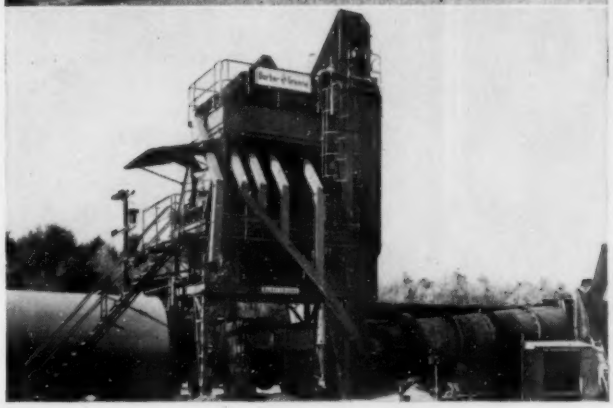
PLANT NO. 2

MAY '56



PLANT NO. 3

SEPT. '56



PLANT NO. 4

Bayer and Mingolla had been in the asphalt paving business for many years before introduction of the BatchOmatic. During these years they had vast experience with many different makes of batch-plants, and they are thus ideally suited to judge the merits of the various plants available.

Record production. Bayer and Mingolla's first BatchOmatic is a 4000-lb. Model 894. It had turned out 145,000 tons (including 20,000 tons for the Mass. Turnpike) by October, 1956. Plant No. 3 with a 2000-lb. rated capacity has consistently produced as much as 84 tons per hour.

Record ease of erection. Although set up by a crew completely inexperienced with the BatchOmatic, Plant No. 1 was ready to produce just three days after erection started.

Record low repair costs. The second Model 894 BatchOmatic has produced more than 102,800 tons for turnpike and state work. Total repair costs for this tonnage amounted to $200 or just 2/10ths of a cent per ton of mix produced. After producing more than 145,000 tons, Plant No. 1 is still using the original paddles and pugmill liners.

Exclusive features include:

Simultaneous weighing of all sizes of aggregate . . . eliminates the human element in achieving accuracy and maximum capacity.

Instant change-over from automatic to manual operation . . . provides mixes for the drive-in trade . . . instantly reset to preset repetitive cycle operation.

New Dyna-Mix pugmill . . . gives thorough coating in less time than any other pugmill.

Instant, positive inspection of aggregate gradation and weight.

Plant No. 4, a Model 894, has just been shipped and will probably be in operation before this ad appears.

Literature on request.

57-10-WB

Barber-Greene BG

AURORA, ILLINOIS, U.S.A.

CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

To order these helpful booklets check the reply card opposite page 34.

Points to Consider in Filter Sand Selection

332. Best operation of rapid sand filters requires filter media which is hard, properly shaped, carefully graded and perfectly clean. Filter sand and gravel which meets these exacting requirements is available on short notice from Northern Gravel Company, Box 307, Muscatine, Iowa.

How Your Filter Washing Can Be Improved

368. More effective sand washing with elimination of mud balls and bed cracking with resultant longer filter runs are claimed for the Palmer Filter Red Agitator, described in bulletins issued by Palmer Filter Equipment Co., Erie, Pa. Check the reply card.

Welded Steel Pipe from 6 to 10 3/4" Diameter

382. High grade butt welded light-weight steel pipe from 8 to 16-gauge in 20, 30 and 40-foot lengths, plain or asphalt coated, with choice of joints. Also available up to 0.188 wall. Check uses for municipal water lines, irrigation, well casings and many other applications. Self explanatory literature from Valley Mfg. Co., Valley, Nebraska.

Roll-On Joint Pipe For Water, Sewage or Other Liquids

388. American Roll-on Joint Pipe that is centrifugally cast in sand-lined molds for water, sewage or other liquids is described completely in catalog just released by American Cast Iron Pipe Co., Birmingham, Alabama. Applications, specifications, design, class, assembly and disassembly are included. Check the reply card.

What You Should Know About Hypochlorination

395. "Hypochlorination of Water" is the name of an informative publication issued by Olin Mathieson Chemical Corp., Industrial Chemicals Div., Baltimore 3, Md. In it there is a discussion of chlorination theory, practice and equipment; control of algae, tastes and odors; and laboratory testing.

Modern Filtration of Swimming Pool Water

351. Latest data on filtration systems for swimming pools of 50,000 gallon capacity and over is presented in 24-page bulletin No. 625 by R. P. Adams Co., Inc., 328 East Park Drive, Buffalo 17, N. Y. Design and operating data are provided, together with material to assist you in choosing the right filter for your pool. Check the reply card.

Cleaning and Relining Water Pipe the Easy Way

397. Complete facilities for relining cast iron or steel water pipe lines in place from 4" to 144" in diameter, with both the Tate process and the Centriline process offered by Pipe Linings, Inc., 2414 E. 223rd St., Wilmington, Calif. For full information on cleaning and relining pipe with only momentary interruption of service, check the reply card.

U. S. Tyton Joint Pipe

490. An eight page booklet on centrifugally cast, Tyton Joint pipe for water or other liquids has been announced. The newly developed Tyton Joint is simple, sturdy and tight. Illustrations show details of joint and method of assembly. Write U. S. Pipe & Foundry Co., Birmingham 2, Ala., or check the reply card.

Bulletin On Locating Trouble in Pumps

533. A bulletin to help locate and correct common ailments of rotary, centrifugal and steam pumps has been released by Worthington Corp., Merchandising Sales Dept., Harrison, N. J. Pictures give a full description of pump troubles—from failure to deliver water to the loss of capacity after starting.

Plastic Pipe For Liquids and Gases

514. Kraloy rigid polyvinyl chloride plastic pipe can be used for liquids and gases and will not rust, rot or corrode. Write to Kraloy Plastic Pipe Co., 4720 E. Washington Blvd., Los Angeles, Calif., or check the reply card for complete details on this lightweight pipe.

3-Way Instrument Locates Underground Pipes and Leaks

540. A single instrument, the Goldak Model LC-15, provides all-around help in water system maintenance by locating pipes and valves and detecting leaks. One-man operated, accurate and dependable, this instrument is fully described in the booklet entitled "Locating Underground Pipes" and related literature. Get your copy from the Goldak Company, Inc., 1544 W. Glenoaks Blvd., Glendale 1, Calif.

Manhole, Water or Gas Valve Box Locator

603. A valve box locator or manhole finder is available from Aqua Survey & Instrument Co., 2012 Leslie Ave., Cincinnati 12, Ohio. Rugged and compact with no wires, batteries or switches, the Aqua box locator should be in every service car. For more information and price, check the reply card.

Data on Mechanical Joint Tapping Valves and Sleeves

605. Eddy mechanical joint tapping valves and sleeves are described in literature available from Eddy Valve. Also described are repair sleeves for cast iron and asbestos cement water mains. Write Eddy Valve Company, Waterford, New York, or circle the reply card for your copy.

Flexible Plastic Pipe For Water Distribution

708. A new-type polyethylene resin flexible pipe is described in Catalog No. 401 available from Orangeburg Mfg. Co., Inc., Orangeburg, N. Y. Fittings, installation, size and weight tables and physical properties are several of the sections covered.

Palatable Water Achieved By Proper Aqua Nuchar Dosage

714. Aqua Nuchar activated carbon will render water palatable only if proper dosages are used. For complete information and technical help write Industrial Chemical Sales, Division West Virginia Pulp and Paper Co., New York Central Bldg., 230 Park Ave., New York 17, N. Y., or check the reply card.

How Mud-Jack® *stabilizes sub-grades*

Here is an easy, low-cost way to raise settled sidewalks, street slabs, curbs, gutters, driveways. Koehring Mud-Jack pumps soil-cement slurry under pressure into small holes drilled through pavement. This displaces air pockets, water or water-saturated materials, raises the concrete slab, leaves firm permanent sub-grade. Two sizes: compact, portable No. 10 for cities, and the big No. 50 Mud-Jack for preventive maintenance and low-cost repairs on highways.

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Galion, Ohio

To order these helpful booklets check the reply card opposite page 34.

Here's the Equipment That Really **Stretches** Maintenance Budgets!

AIRPLACO® CONCRETE GUNNING EQUIPMENT

For maximum efficiency, speed and economy, public works officials are turning to the new AIRPLACO Portable Concrete Gunning Rig. From simple road, curb and street repairs to major concrete reconstruction projects on bridges, docks, sewers, reservoirs and many other structures, you can do the job faster and at far less cost with the AIRPLACO Rig.

The AIRPLACO Rig consists of the SAND-LOADER for rapid loading of sand; the MIX-ELVATOR* for automatic proportioning, continuous mixing, elevating and screening; and either the NUCRETOR* or BONDACTOR* for the actual application of the concrete. (The NUCRETOR or BONDACTOR is available separately.) The entire unit can be towed easily by your pick-up or compressor truck. No set up time required.

Investigate AIRPLACO concrete gunning equipment now.

*Registered Trade Names

Whatever Your Specific Requirements, There's an AIRPLACO Concrete Gun to Do the Job

AIRPLACO concrete gunning equipment is available in a wide range of sizes to fit your production and job requirements from ½ to 7 cubic yards of aggregate per hour, and using air compressors with 75 to 600 CFM capacity.

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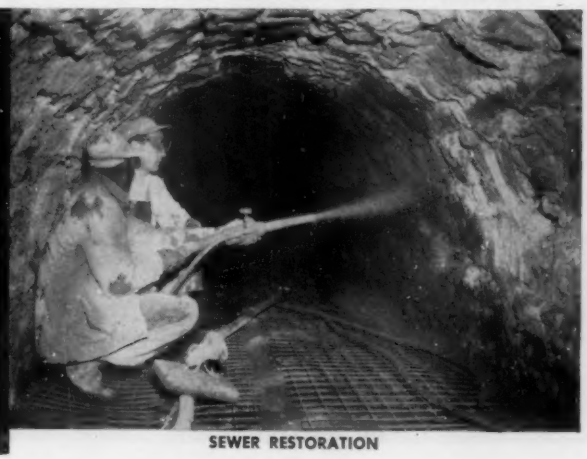
MANUFACTURERS OF ADVANCED DESIGN CONCRETE GUNNING, MIXING, GROUTING AND SANDBLASTING EQUIPMENT.

DOCK and HARBOR REPAIRS



SEWER RESTORATION

Helpful Data on Water Meters

330. It is to the interest of every water works superintendent and engineer to have full data on dependable Badger water meters and related meter products. Complete data on all types of disc, turbine and compound meters, meter test equipment, yokes, strainers and alarm registers are supplied in an attractive binder by Badger Meter Mfg. Co., Milwaukee 45, Wisconsin. Use the reply card to order your copy.

Important Factors in Water Meter Selection

463. Interchangeability of parts is an important advantage that is yours when you use Trident meters. The newest parts fit your oldest Tridents so you modernize when you repair. Get full data on the entire Trident water meter line by checking the reply card or write to Neptune Meter Co., 19 West 50th St., New York 20, N. Y.

SEWERAGE AND WASTE TREATMENT

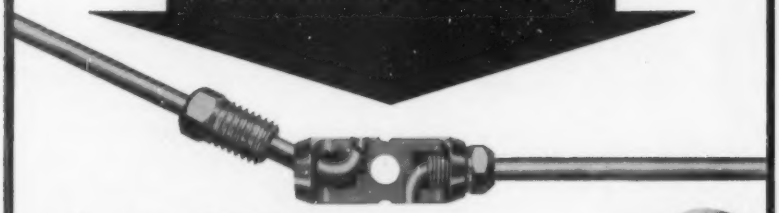
Submersible Pumps For Municipal Use

185. A new 12-page bulletin that describes the line of BJ submersible pumps is available from Byron Jackson Pump Inc., P. O. Box 2017, Terminal Annex, Los Angeles 54, Calif. Construction and operation of the pumps are covered along with a handy selection chart that gives capacity and head performance.

Get Data Now on This Catch Basin Cleaner

198. Simple powerful pneumatic bucket is featured by Netco Catch Basin Cleaner. Folder 33A gives details and illustrates operation of complete self powered truck mounted unit. Netco Div., Clarke Wilcox Co., 118 Western Ave., Boston 34, Mass. Check the reply card.

It's FLEXICROME FOR HIGH SPEED SEWER RODDING!



25 years ago "Flexible" Steel Sewer Rods took the men out of the sewers. When power turning was introduced, FLEXICROME STEEL had to be developed to withstand the added stresses and strains

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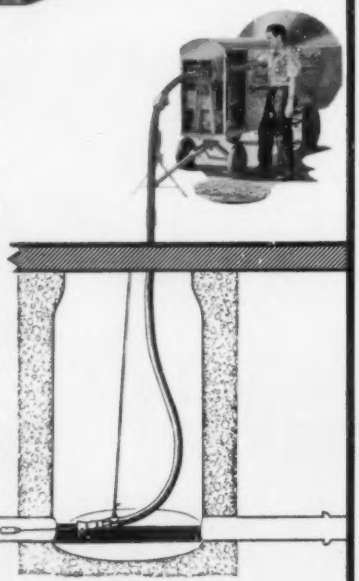


FLEXIBLE INC.

1085 SPENCERVILLE ROAD, LIMA, OHIO
3786 DURANGO AVE., LOS ANGELES 34, CALIF.
351 W. JEFFERSON BLVD., DALLAS, TEXAS

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers.

Sewer Design Flow Chart Based on Manning Formula

154. A large-scale, convenient flow chart based on the Manning formula, together with typical examples of use, is available from Johns-Manville, 22 East 40th St., New York 16, N. Y. To get your copy check the reply card or write to the manufacturer and ask for Bulletin TR-94A.

Reduce Labor Costs With Power Sewer Cleaners

189. A complete line of sewer cleaning equipment, including labor saving power units and all types of buckets, cables, rods and flushing equipment are listed in catalog of the Turbine Sewer Machine Co., Division of Chas. H. Stehling Co., 1303 N. Fourth St., Milwaukee 12, Wis. Check the reply card for your copy.

A Fully Rotary Compressor by Jaeger

209. Complete information is available from The Jaeger Machine Co., Columbus 16, Ohio on this 2-stage, oil-cooled rotary compressor. Features include 80% fewer moving parts, up to 30% less weight, vibrationless operation and 100° cooler air. For full details check the reply card.

Waste Treatment Equipment For Municipalities

243. A general description of Chain Belt Company's line of waste treatment equipment is contained in a bulletin from Chain Belt Co., Milwaukee 1, Wisc. Equipment for large and small sewage or industrial plants is covered.

Valuable Information on Underground Pumping Stations

246. The complete prefabricated underground pumping station is fully described in a bulletin just released by Zimmer & Francescon, 1715 Fifteenth Street Place, Moline, Ill. Construction features, corrosion control, electric controls, specifications, pumping equipment and installation are a few of the items covered. Check the reply card.

Data Offered on Water, Sewage and Waste Treatment Equipment

263. Equipment for sewage treatment, water purification and industrial waste treatment is described in a 16-page Book No. 2440, published by Link-Belt Co., Colmar, Pa. Case histories, photographs and schematic drawings are included. Straightline and Circuline collectors, Thru-Clean and Straightline bar screens, Tritor screens, flash mixers, scum breakers and other units are described.

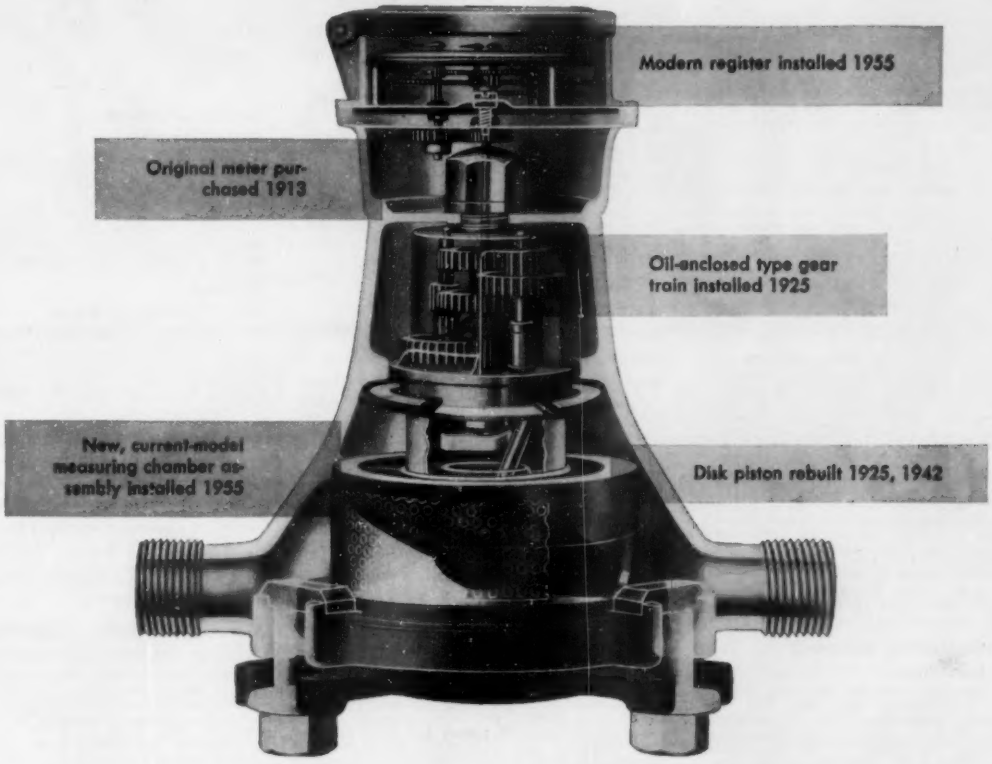
How and Where to Install A Septic Tank System

270. A manual on modern sewage disposal methods for individual dwellings, camps and rural schools has been released by Brown Co., 150 Causeway St., Boston, Mass. Location, size of and building the tank, how large a disposal field and laying out the field are discussed.

How to Dispose of Sewage and Industrial Sludges

281. Get full information on the C. E. Raymond System of combined incineration and sludge drying providing high temperature deodorizing for nuisance-free sludge disposal. Flexible layouts fit large and small communities. Use handy reply card or write Combustion Engineering Inc., Raymond Div., 1315 No. Branch St., Chicago, Illinois.

To order these helpful booklets check the reply card opposite page 34.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Original meter purchased 1913
Oil-enclosed type gear train installed 1925
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It was built in 1913 . . . but it's almost as new as 1957. Over the years, working parts have been replaced. Its performance matches every standard of modern metering practice.

The parts used to repair this meter at its last overhaul are identical to those used in the latest Trident meters. They embody every thoroughly tested advancement known to the science of metering.

Designing modern parts to fit "old" meters has been a rigid Neptune policy for over 50 years. It is just one of the extra advantages that make Tridents a better buy . . . both for today and for the years to come.

274

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To order these helpful booklets check the reply card opposite page 34.

Complete Catalog for Engineers Shows Water and Sewage Plant Equipment

191. The complete line of Jeffrey equipment for treatment of water, sewage and industrial wastes is covered in 64-page Catalog 905. Detailed information is provided on bar screens, grinders, grit collectors, "Jigrit" washers, sludge collectors, feeders, conveyors and other related units. Photos and drawings of installations plus capacity tables complete this valuable booklet. Use card or write Jeffrey Mfg. Co., 947 N. 4th St., Columbus 1o, Ohio.

Centrifugal and Turbine Type Pumps For Water and Sewage Plants

321. Turbine-type pumps, close or flexible couple drive, side suction centrifugal pumps and mixed flow pumps are described in Catalog M available from Aurora Pump Div., The New York Air Brake Co., Loucks at Dearborn, Aurora, Ill. Included is a pump selection guide.

Flexible Bucket Machine Catalog

386. Sewer cleaning bucket machines with the automatic bucket dumper and the safety booster clutch are described in Catalog No. 57-Z available from Flexible, Inc., 3786 Durango Ave., Los Angeles 34, Calif. Specifications, features, models, operation and attachments are covered. Check the reply card today.

Combat Unpleasant Odors At Municipal Sanitation Sites

404. Malodors at municipal refuse disposal sites, waste treatment plants and incinerators may be effectively "neutralized" by the odor masking products of Rhodia, Inc. Be sure to investigate this means of eliminating complaints from unpleasant odors. Write Rhodia, Inc., 60 East 56th St., New York 17, N. Y. or check the reply card.

Helpful Engineering Data on Cast Iron Pipe

422. Complete data on McWane Super-DeLavaud centrifugally cast pipe with bell and spigot or mechanical joints is contained in Bulletin WP-54, issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala. Size range includes 2" through 12" diameters, 18 feet long.

Getting Improved Sludge Dewatering With Non-Clogging Vacuum Filters

425. Latest information on the Komline-Sanderson "Coilfilter," which features non-clogging, permanent filter media to obtain constant output and low operating cost is presented in illustrated Bulletin No. 106 by the Komline-Sanderson Engineering Corp., Peapack, N. J Be sure to investigate this improved method of sludge dewatering. Check the reply card today.

How to Choose the Right Self-Priming Centrifugal Pump

427. Descriptive folders on the complete line of contractors' pumps have been issued by the Gorman-Rupp Co., Mansfield, Ohio. 2-in. to 10-in models are illustrated, performance tables are shown and pump selection tables are included to assist in choosing the proper pump for different jobs.

Use The Reply Card

Pneumatic Ejectors—Their Operation and How to Select the One You Need

500. Comprehensive data on pneumatic ejectors is furnished in a 28-page catalog issued by the Ralph B. Carter Co., 210 Atlantic Street, Hackensack, N. J. The principle of operation, construction features, operating arrangements and controls are discussed fully. Selection charts with illustrative examples help in specifying the proper ejectors, air tanks and compressors. Complete layout dimensions and sample specifications are included. To get this valuable reference, Bulletin 5408, just check the Handy reply card.

V-Notch Chlorinators For Water and Sewage Plants

590. Bulletins on the Series A-711 and the Series A-712 chlorinators are available from Wallace & Tiernan Inc., Box 178, Newark, N. J. Covered in the literature are design features that include operation, installation and maintenance. Simplified flow diagrams in color are included showing the operation of the units. Class, capacities, feed ranges and electrical requirements are described in the technical data section. For your copies, check the reply card.

Underdrains—Hidden But Important Filter Components

549. "Armcre" filter underdrain blocks are one-piece units made of vitrified salt-glazed clay. Ducts occupy 50% of floor cross section and air openings aggregate 24% of floor area. Described in several leaflets and data sheets available from Ayer-McCarel Clay Co., Brazil, Ind. Check the reply card.

Sludge Digestion Time Reduced

604. The Catalytic Reduction Process may be applied to reduce the period required for biological sludge digestion by permitting increased solids loading. It may be used for new plants or adapted to existing overloaded digesters. Bulletin 145, Chicago Pump Co., 422 Diversey Parkway, Chicago 14, Ill., discusses application of the process.

Biosorption Activated Sludge Plant

654. The "Biosorption" plant treats sewage and industrial wastes by a high rate activated sludge process. Flow diagrams, equipment and design of plants are covered in bulletin from Infilco Inc., Tucson, Ariz. Check the reply card.

Controls For Use in Pumping Stations and Sewage Plants

662. Single and multi-pump sump controls, pressure operated for use in pumping stations and sewage disposal plants are described in literature available from Healy-Ruff Co., Water Level Controls Div., 2255 University Ave., St. Paul 14, Minn. The two principal types of pressure operated sump controls are covered along with general descriptions and features. Check the reply card.

Catalogs on Diesel, Dual-Fuel, Natural and Sewerage Gas Engines

679. Heavy duty diesel, dual-fuel, natural and sewerage gas engines for continuous stationary service are described in literature available from Chicago Pneumatic Tool Co., 8 East 44th St., New York 17, N. Y. Check the reply card for details on 3, 4, 5, 6 and 8 cylinder models and in capacities from 120 to 3000 hp.

FILTER SAND AND GRAVEL

Produced from an inland pit hence free from river contamination and foreign matter.

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Available in 6", 6⅝", 8", 8⅝", 10", 10¾" diameters, from 16 gauge up to and including .188 wall thickness; 20, 30 or 40-foot lengths; and in plain or belled ends. Quotations available for Victaulic or Dresser end processing, and coating.

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Write or call for full specification and production data to: **Steel Pipe Division**

WITH A Clamshell

A "PAYLOADER" gives you more machine for your investment. It travels through city streets at traffic speeds under its own power, works on paved or unpaved surfaces without damage and, with its attachments, handles more work than any other tractor-shovel.

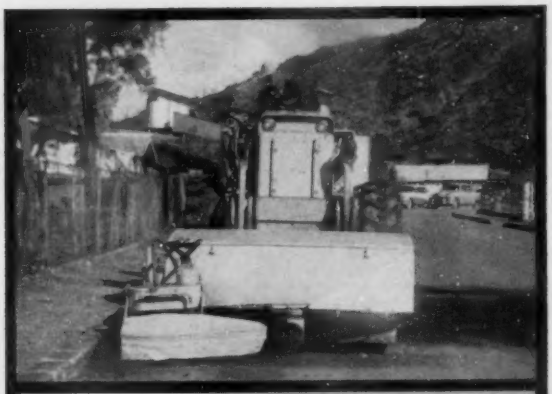
The patented DROTT "4-in-1" bucket (above), available on rubber-mounting exclusively with "PAYLOADER", combines shovel, clamshell, scraper and bulldozer action in a single bucket arrangement. For full year-'round usefulness, it can be equipped with snow handling tools, including blower-type plow (below), V and one way reversible blade plows and large capacity snow buckets.

4-wheel-drive "PAYLOADER" models are big and rugged, have up to 9,000 lb. carry capacity. A nearby Distributor will welcome your inspection . . . will demonstrate why a "PAYLOADER" tractor-shovel is the most useful machine your community can own.

WITH A Snow Plow

PAYLOADER®
MANUFACTURED BY
THE FRANK G. HOUGH CO. LIBERTYVILLE, ILL.
SUBSIDIARY—INTERNATIONAL HARVESTER COMPANY

126A



WITH A Sweeper

If you're looking for the *one, economical* answer to material handling and maintenance problems, you have it in a "PAYLOADER" tractor-shovel. You make *one* investment for a "PAYLOADER" and, at a fraction of the cost of individual machines, get the *economy* benefits of multiple machine usefulness.

Both the pick-up sweeper and the hydraulic back-hoe interchange quickly and easily with the standard "PAYLOADER" bucket. The sweeper cleans streets, alleys and driveways and dumps its accumulated load into trucks; with the hoe attachment, the "PAYLOADER" becomes a mobile trencher that digs 12' deep, in a 190° radius.

There are other useful, fast-switch attachments your nearby Distributor can show you to prove "PAYLOADER" is the most versatile and economical machine for your equipment pool. The Frank G. Hough Co., 761 Sunnyside Ave., Libertyville, Ill.

WITH A Back Hoe

PAYLOADER®
MANUFACTURED BY
THE FRANK G. HOUGH CO. LIBERTYVILLE, ILL.
SUBSIDIARY—INTERNATIONAL HARVESTER COMPANY

126B

To order these helpful booklets check the reply card opposite page 34.

Solution To Three Municipal Problems

598. Many municipalities can now solve the waste disposal problem and prevent air pollution without heavy financial burden. Incineration plants are erected from 1 to 40 tons per hour and they also can be designed to generate steam. For full details write Incineration Engineering & Power Co., A Div. of Coastal Oil Co., 744 Broad St., Newark 2, N. J., or check the reply card.

Spiragester, A Combination Clarifier and Digester

709. A 22-page catalog is available from Lakeside Engineering Corp., 222 W. Adams, Chicago, Ill. describing the Spiragester. Check the reply card for operation of the unit, advantages, specifications, samplers and painting.

STREETS AND HIGHWAYS

Information on The Ottawa Heavy-Duty Backhoe

25. Features of this backhoe are an automatic ejector bucket; two levers do four operations; and a powerful hydraulic system with mechanical linkage to provide more digging power. For complete details check the reply card or write Ottawa Steel Div., L. A. Young Spring & Wire Corp., Ottawa, Kans.

How to Select Prestressed Concrete Bridge Members

26. Colorful folder, well illustrated, shows manufacture of "Amdek" prestressed bridge members and provides selection tables covering several AASHO loadings. Full data from Concrete Products Div., American Marietta Co., 104 East Ontario St., Chicago 11, Ill. Check the reply card for your copy of this helpful reference bulletin.

Bitumuls Paving Handbook Full of Useful Data

23. The latest edition of the Bitumuls Paving Handbook covers a wealth of practical data on paving methods and materials, road and airport paving specifications and construction details, complete tabular data on asphaltic binder applications and aggregate requirements, condensed Asphalt Institute specifications plus data on Laykold compounded asphalts for flooring, tennis courts, protective coatings and waterproofing. You can have a copy by checking the reply card. American Bitumuls & Asphalt Co., 200 Bush St., San Francisco 20, Calif.

Levels Sidewalks and Curbs Quickly and Easily

29. How the Mud-Jack Method for raising concrete curb, gutter, walks and streets solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a bulletin by Koehring Company, 3026 W. Concordia Ave., Milwaukee 16, Wis. Check the reply card.

How to Solve the Brush Disposal Problem

277. Fitchburg Chippers, engineered to solve the brush disposal problem reduce troublesome brush and trimmings to tiny, easy to-dispose-of chips. Several models are available to meet your needs. May be mounted on truck body or on trailer, tractor or jeep. Full details in interesting, profusely illustrated 16 page bulletin. Write Fitchburg Engineering Corp., Fitchburg, Mass.

Manual on Apparatus For Tests of Soils, Concrete and Asphalt Materials

518. The new 128-page catalog released by Soiltest, Inc., 4711 W. North Ave., Chicago 39, Ill., contains descriptions and illustrations of over 1350 items of apparatus for engineering tests of soils, concrete, asphalt and construction materials. It lists items ranging from pocket penetrometers for soil, to pavement deflector instruments for asphalt, and 200,000 pound compression testing machines for concrete.

How to Save Time on Curb and Gutter Work

143. Every type of curb and gutter work is illustrated in the 12-page Heltzel catalog on steel forms for building concrete curbs, gutters and sidewalks. Time-saving setups show how to speed up the job and save money. Get your copy from Heltzel Steel Form & Iron Co., Dept. PW, Warren, Ohio. Use the reply card to get your copy.

What Should You Look For In a Power Sweeper?

206. Helpful information to aid you in the selection of a power sweeper to fit your needs is provided in Bulletin 85.2, issued by G. H. Tennant Co., 755 No. Lilac Drive, Minneapolis 22, Minn. Full data on the highly maneuverable Tennant Model 75 Sweeper is included. Get your copy by checking the reply card.

New Reflectorized Sign Faces Refurbish Old Traffic Signs

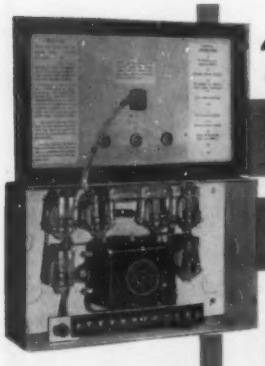
292. Get complete details on new "EZ-On" traffic sign faces ready for immediate shipments. Reflectorized faces cost only a fraction as much as new signs and are easily attached to existing traffic signs. Grace Sign & Mfg. Co., St. Louis 18, Mo.

Davis Back-Hoe and Davis Loader

312. Literature is available from Massey-Harris-Ferguson, Inc., Industrial Division, 1009 S. West St., Wichita, Kans., describing the new Davis backhoe and Davis loader. The back-hoe can dig at right angles and to a depth of 13 ft. and detaches in 5 minutes. Both units are available for most popular makes of tractors.

Hydrocrane Used As A Backhoe, Crane or Clamshell

606. When your work calls for lifting, digging and trenching all in the same day you need a machine that converts from crane to clamshell to hoe quickly and easily. Check the reply card or write Bucyrus Erie, South Milwaukee, Wisc. for information on the Hydrocrane.



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CONTROL

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Dependable Synchro-Start controls provide full automatic starting and stopping according to the operation of any type of pilot switch. Full protection is provided all the time the engine is starting or running. In case of an abnormal condition, such as low oil pressure, overheating, overspeeding, failure to start, etc., the engine will be shut down before any damage can occur and a visual signal will show the exact cause of failure.

Write today for the new Synchro-Start catalog, or see your engine dealer.

Automatic STARTING
Full PROTECTION
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8151 N. RIDGEWAY AVE., SKOKIE, ILL.
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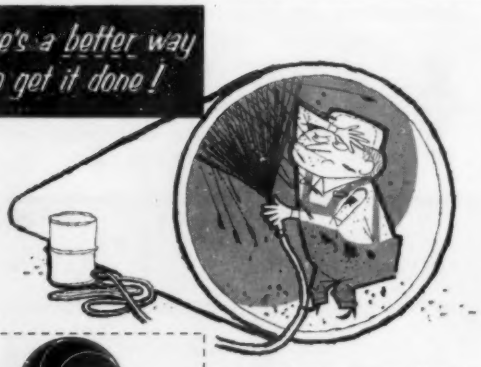


Coal tar lining is applied uniformly by centrifugal process

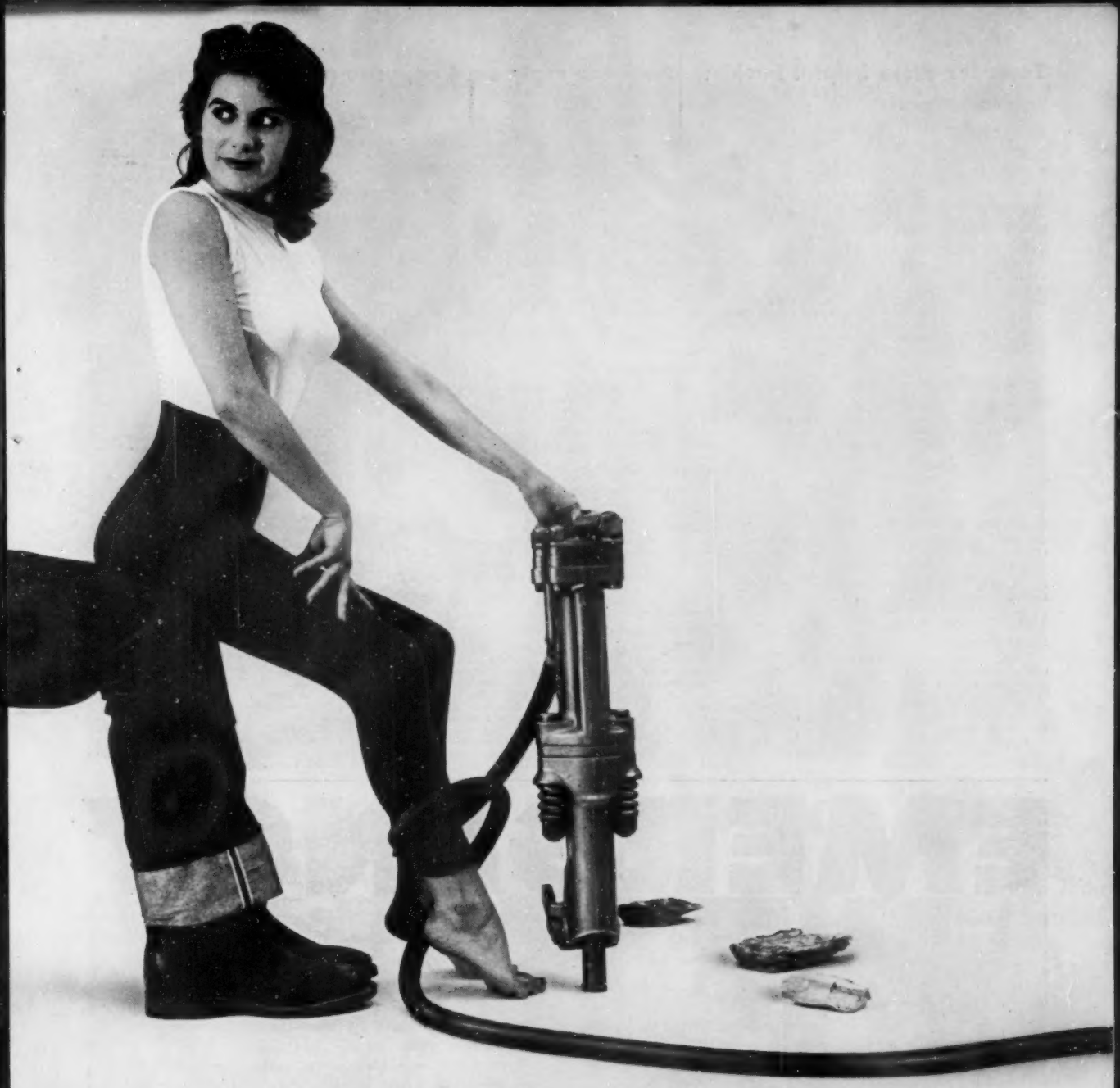
Provides mirror-like surface with a tight bond

Centrifugal spinning of coal tar lining to large diameter pipes, penstocks, and discharge lines, can now be done quickly, efficiently, and economically by specially designed equipment. Expert crews and complete mobile equipment available to serve you.

Write for full information TODAY!

Specializing in Pipe Protection Problems
• Tate and Centriline "In Place" Interior Cement Mortar Lining • "In Plant" and "Railhead" Centrifugal Spinning of Cement Mortar or Coal Tar Linings—Somastic® Exterior Coating • Pipe Wrapping • Reclamation: Removal of Old Wrapping, Straightening, Blasting, Beveling, Testing.

PIPE LININGS Inc.
2414 East 223 St. (P.O. Box 457)
Wilmington, California



Surfaces lap-finished...

in the Le Roi Model C11 Breaker

Lap-finishing means the honing of surfaces to precision tolerances. For example, lap-finishing of the main piston bore after grinding increases breaker efficiency. This type of honing provides a better retaining surface for costly lubricant. Also, honing off the "high" spots cuts air consumption. This precise mating of parts is one reason why the C11 breaker outperforms and outlasts other makes.

But the C11 will sit well with you for reasons other than lap-finishing. For instance, air cushions above and below the hammer make the C11 an exceptionally easy breaker to hold. An oil regulator in the handle provides correct lubrication for all moving parts. Another long-life feature is the four-bolt construction that secures the handle. Investigate these and other C11 refinements today. See it, try it at your Le Roi distributor. Or write the Le Roi Division, Westinghouse Air Brake Company, Milwaukee 1, Wisconsin.

LE ROI
NEWMATIC
AIR TOOLS

PORTABLE AND TRACTAIR® AIR COMPRESSORS • STATIONARY AIR COMPRESSORS • AIR TOOLS

To order these helpful booklets check the reply card opposite page 34.

Hydraulic Backhoe For Many Makes of Tractors

456. A backhoe that digs sewer systems, culverts, water mains, foundations and ditches is described fully in literature from Henry Mfg. Co., Inc., 1700 N. Clay St., Topeka, Kans. Check the reply card for specifications and details.

Better Traffic Signs By Using Plyglaze Overlaid Plywood

496. Plyglaze high density overlaid plywood requires no protective paint coating when used for traffic control signs. The plyglaze surface provides an ideal base for permanent weatherproof bonding, and it will not check, blister or deteriorate when marred by bullet holes. For further information write St. Paul & Tacoma Lumber Co., Dept. P.W., Tacoma 1, Wash., or check the reply card.

Pre-Assembled Dowel Units For Highway and Airport Construction

537. Laclede dowel assemblies for expansion, contraction and construction joints are precision welded into one unit and are maintained in rigid alinement. For full details write Laclede Steel Co., St. Louis, Mo., or check the reply card today.

Air Tool Trouble Chart and Bulletin Available

548. An 8-page bulletin explaining troubles encountered, causes, and remedies when using air tools is available from Sales Promotion Dept., Le Roi Div., Westinghouse Air Brake Co., Milwaukee 1, Wisc. Pictures and drawings are used widely to illustrate construction.

Better Mowing and Brush Removal

608. Fast, versatile tractor drawn Wood rotary mowers are available in a large selection of models to suit all types of municipal and highway department maintenance requirements. Be sure to investigate these units and discover how costs of roadside mowing, brush cutting, leaf mulching and park maintenance can be reduced with efficient equipment. Get full details by checking the reply card or from Wood Bros. Mfg. Co., Oregon, Ill.

Eaton 2-Speed Axles For Your Trucks

264. Truck axles that provide easy shift, supply positive lubrication and have a self-contained air brake are available from Eaton Mfg. Co. For complete information on these rugged axles check the reply card or write Eaton Mfg. Co., Cleveland, Ohio.

Survey Marking and Identification Equipment

601. Surveyor stakes, identification caps and monument markers are described fully in literature available from Bathey Mfg. Co., Plymouth, Mich. Price schedules and descriptions are included. Check the reply card today.

A Completely Hydraulic Ladder

610. This completely hydraulic ladder is described in a new catalog published by J. H. Holan Corp., 4100 West 150th St., Cleveland 11, Ohio. Detailed drawing of the pedestals, throttle control and ladder construction are included. Check the reply card today.

Design of Concrete Pavements For City Streets

657. Sections covered in this manual are classes of streets as to traffic, quality of concrete, working stress and safety factor, types of pavement design, design procedure, jointing of municipal pavements and use of distributed steel. Check the reply card or write Portland Cement Association, 33 West Grand Ave., Chicago 10, Ill.

Service Bodies to Suit Your Maintenance Needs

706. Service bodies, tailored to fit the needs of any municipal department and featuring many outstanding features of construction and design, are described in literature of Morrison Steel Products, Inc., 601 Amherst St., Buffalo 7, N. Y. The line has models to fit all popular truck chasses; ½ to 1½-ton; single or dual wheel. Be sure to check the 18 different compartment arrangements and engineered accessories offered for time-saving convenience and efficiency of your maintenance crews.

Truck Loader For Municipal and Highway Use

634. An illustrated bulletin describing the M-B truck loader operation and specifications is available from the M-B Corp., New Holstein, Wisc. Check the reply card for complete information.

Crezon Plywood Signs Have Long Life Expectancy

641. Crezon overlaid plywood signs are described fully in literature available from Crown Zellerbach, San Francisco 19, Calif. Material is strong and rigid, resists bending or tearing loose from the pole and there's neither checking nor blistering from heat or freezes.

Sweepers Handle A Variety of Jobs In Every Season

684. Mechanical drive one-way and pull type 2-way sweepers and hydraulic 2-way sweepers that are tractor-mounted or loader-mounted are fully covered in literature from M-B Corp., 1611 Wisconsin Ave., New Holstein, Wisc. Jobs like cleaning dust, dirt and snow from streets and highways and sweeping park lawns are a few of the sweepers applications. Check the reply card.

CIVIL DEFENSE

Effective Warning Signals Help Safeguard Communities

374. Nation-wide encounters with floods, windstorms and fires have demonstrated the multiple advantages of air raid warnings and signal systems as a means of summoning civil defense and rescue squads to deal with natural disasters. Get complete information on efficient size and spacing of sirens from Federal Sign and Signal Corp., 8733 So. State St., Chicago 19, Ill. Check the reply card.

EMERGENCY

When the caulking on a 16-inch water main gave way, the Water Department of Beach Haven, N.J. had an emergency on its hands.

Pressure from a 100,000 gal. water tower, only 50 feet from the break, threatened further damage and water loss.

Beach Haven sent its team of Henry Earthmovers into action. The Henry Backhoe dug a trench 6 ft. deep by 5 ft. wide—in 20 minutes.

The leak was repaired and the trench quickly backfilled with the Henry Industrial Tractor Shovel.

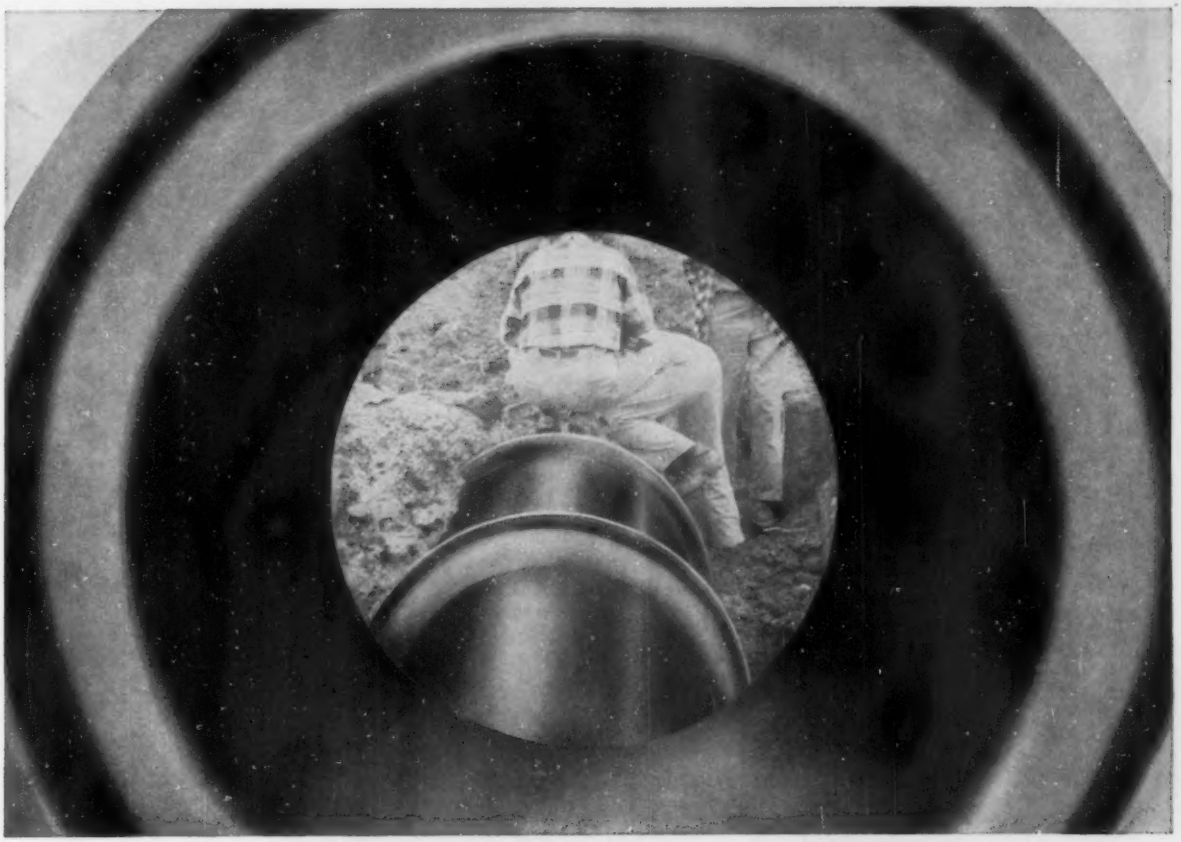
Considering the frozen ground, mud, and necessity for shoring up to prevent a cave-in, the operator and assistant superintendent report this estimate:

With former methods using manual labor, it would have taken 3 men 16 hours to dig that excavation.

Time saved by using Henry Earthmovers in this emergency: 15 hours, 40 minutes. Add to this the savings on labor cost, further damage to the main, disruption of water service . . . and you'll see why—

"You can do it BETTER with a HENRY!"

To order these helpful booklets check the reply card opposite page 34.



Greenville, S.C. Builds for 1990 with CLAY PIPE

The new sewerage program now underway in Greenville looks far into the future of this fast-expanding area. Existing main and outfall sewers are being paralleled by larger ones designed to serve the community until 1990, or until the present 130,000 population has grown to 233,000. Greenville is following the pattern of hundreds of other cities which are building for the future by specifying the *guaranteed* pipe—Vitrified Clay. The total project will cost $3,500,000.

"Because of the character of the wastes handled and expected to be handled by the sewers," reports Superintendent E. D. Fry of the Greater Greenville Sewer District Commission, "it is the policy of the Commission to use Vitrified Clay Pipe wherever possible and to require it to be used by the subdivisions of the sewer district." Clay Pipe is the *only* pipe that *never wears out*.

Consulting Engineers—**Wideman and Singleton**
Contractors—**A. H. Guion & Co., Penden Construction Co., Glenn Construction Co.**
Greater Greenville Sewer District Commission—**E. D. Fry, Supt.**

Vitrified
THE PUBLIC *KNOWS* CLAY PIPE IS BEST
CLAY PIPE NEVER WEARS OUT!
CLAY PIPE

NATIONAL CLAY PIPE MANUFACTURERS, INC.
1820 N. Street, N.W., Washington 6, D.C.

206 Connally Bldg., Atlanta 3, Ga. • 100 N. LaSalle St., Rm. 2100, Chicago 2, Ill. • 703 Ninth & Hill Bldg., Los Angeles 15, Calif. • 311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio

To order these helpful booklets check the reply card opposite page 34.

ATTENTION! BUYERS OF TRAFFIC SIGNS...

here's the QUALITY TRAFFIC SIGN YOU CAN BUY AT 1/2 THE COST *of* ORDINARY SIGNS

GRACE 'EZ-ON' SIGN FACES

Slip 'EZ-ON' Face over old sign. Crimp wide flanges with crimping tool. That's all there is to it!

APPLY IN LESS THAN 5 MINUTES RIGHT OVER YOUR PRESENT SIGNS

THEY'RE REFLECTORIZED

WRITE FOR FULL INFORMATION

Made in 2 shapes, 2 sizes. Octagon, 24 and 30 in.; Diamond, 24 and 30 in.; Colors, red and white or yellow and black. Standard copy or special. Proven by five years actual usage.

AGENTS WANTED

GRACE SIGN & MFG. CO.
3601 S. Second St.
St. Louis 18, Mo.

SNOW AND ICE CONTROL

Uniform Salt Spreading Saves Material

42. The wide, thin pattern provided by Tarco "Scotchman" spreaders avoids salt waste, saves time and labor. Get Folder BL for full details on their spreader and table of material application rates. Use reply card or write Tarrant Mfg. Co., Dept. PW, Saratoga Springs, N. Y.

Full Line of Weapons for Snow and Ice Battles

268. Whether your snow problems are heavy or light, you'll find equipment for virtually all your needs among the plows and spreaders offered by Good Roads Machinery Corp., Minerva, Ohio. The "Champion Line" of Vee plows and one way and reversible plows with safety blade trip will handle snow removal; for chlorides and abrasives spreading there are five "Jet Line spreader models and the 4-U towed spreader.

Reversible and Roll-Over Type Snow Plows for any Depth of Snow

389. Village, city, county, state and airport officials send for the latest information on Frink's two catalogues on reversible trip-blade and roll-over snow plows. Complete assembly details, specifications and operation are completely outlined. Write to Frink Sno-Plows, Inc., Clayton, Thousand Islands, New York.

Catalog on Equipment For Ice and Snow Control

410. Information on Baker snowplows and Flink ice control spreaders is available from The Flink Co, Dept. 5613, Streator, Illinois. Fully covered are reversible and one-way plows with hydraulic power lifts to meet every specification and single or dual spinner type spreaders. For reference catalog #110 check the reply card.

For Prompt Service Use The Reply Card

New Chemical Discovery Keeps Rock Salt From Caking

535. Sterling Storite is a chemical agent developed especially to keep ice-covered rock salt from caking in storage. The chemical is easy to apply and two pounds will protect one ton of salt. For complete details and information on this chemical write for illustrated bulletin to International Salt Co., Inc., Scranton 2, Penna., or check the reply card.

Snow Plows For Snow Control

539. V-type one-way and reversible plows with hydraulic hoist and having a plowing width of 9½ ft. are described in literature from Gledhill Road Machinery Co., Galion, Ohio. For models, specifications and features check the reply card.

Spreading Equipment For Ice Control

543. An ice control catalog describing the full line of Baughman ice control spreading equipment has been released by Baughman Mfg. Co., Jerseyville, Ill. Included are illustrations and descriptions of truck-mounted spreader bodies, tail gate spreaders, dump body and pull type spreaders and gravity feed spreaders. For your copy of this helpful and interesting booklet check the reply card today.

Sand, Chip and Calcium Chloride Spreader For Ice Control

683. Complete specifications, performance records and prices on the Fox sand spreader are covered in literature from Fox River Tractor Co., Dept. R3, P. O. Box 469, Appleton, Wisc. Spreader can be attached or removed from most any dump truck in 15 minutes and can be operated from 5 to 40 miles per hour. Check the reply card.

REFUSE COLLECTION AND DISPOSAL

Engineering Data on Incinerator Design

118. A comprehensive bulletin which provides full engineering data on municipal refuse incineration is offered by Pittsburgh-Des Moines Steel Co., 3422 Neville Island, Pittsburgh, Pa. This 20-page booklet shows basic requirements for satisfactory incineration, gives incinerator design details and describes modern mechanical stoking, construction features and modernization of existing plants. Get your copy by checking the reply card.

Developments in Refuse Collection

119. The "Dempster-Dumpmaster" system for refuse collection combines the advantages of detachable containers for bulk collection, convenient front-end loading and compaction in a sealed body. Be sure to investigate the application of this system to your collection needs. Complete data offered by Dempster Bros., Knoxville 7, Tenn. Check the reply card today.

General Specifications for Refuse and Garbage Trailers

251. Two bulletins, one on the Pak-Mor 38 cu. yd. tandem axle trailer unit and the other on the Pak-Mor 32 cu. yd. trailer for use with Model GRD Dempster are available from Pak-Mor Manufacturing Co., Box 6147, San Antonio, Texas. General specifications, power train, operating procedures, maintenance and lubrication and other helpful information are included.

Planning A Sanitary Landfill

287. Covered in this manual is how to work various types of terrain efficiently for sanitary landfills. Swampy land, river bottom land, gravel pits, strip mines, and flat land operation are the sections. Write to Caterpillar Tractor Co., Peoria, Ill., or check the reply card for your copy.

Complete Package Dravo Incinerator Plant

584. The Dravo incinerator includes receiving pits, automatic refuse handling system, automatic combustion controls, traveling grate stoker and everything necessary for the efficient operation of the plant with minimum personnel. Write for full information to Dravo Corp., Dravo Building, Pittsburgh 22, Pa., or check the reply card.

CONSTRUCTION EQUIPMENT AND MATERIALS

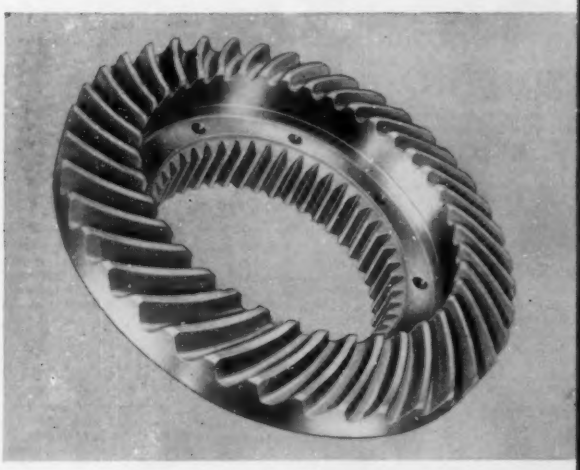
How the "Payloader" Helps Public Officials

190. An attractive booklet "Getting More for the Tax Dollar with Payloaders" makes worthwhile reading for every public official in charge of construction and maintenance of roads, streets, and utilities. You will find illustrations and data showing dozens of ways the "Payloader" is used by cities, counties and states, plus convenient specifications on seven models. Check the reply card or write Frank G. Hough Co., 761 Seventh St., Libertyville, Ill.

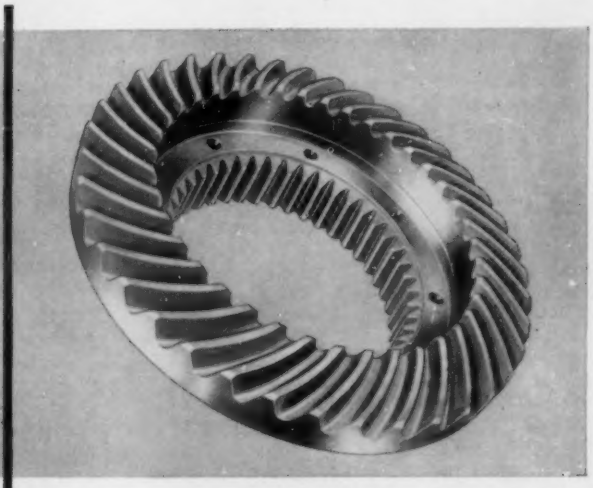
Bridge Concreting, Its Problems and Solutions

390. A 16-page catalog illustrating the concreting problems involved in bridge construction is available from The Master Builders Co., Cleveland 3, Ohio. The catalog covers concreting of piers and bridge decks for highway and railway bridges, and includes discussion of hot and cold weather concreting, the use of lightweight aggregate in bridge work; and placing and finishing problems encountered in bridge work. Check the reply card for Catalog MBR-P-11.

They May Look Alike . . . but they're Not!



Replacement Ring-Gear
Made by Eaton—Axle Division



Replacement Ring-Gear
Not Made by Eaton

Only Genuine Eaton Axle Service Parts are Identical to the Original Production Components

Even Eaton Axle parts may wear out and require replacement. When this happens it is important that repairs be made with Genuine Eaton Axle Service Parts. They are identical to the original production components in design, metallurgy, heat treatment, and quality of finish—made to run together with the other axle parts. Eaton replacement parts are held to the rigid quality standards established for axle components and will deliver the same dependable, low-cost kind of service. So when, after thousands of miles of trouble-free operation, it may become necessary to replace worn parts in an Eaton Axle, it's most economical to make these replacements with Genuine Eaton Axle Service Parts.

MORE THAN TWO MILLION

EATON

AXLES

IN TRUCKS TODAY

EATON AXLE DIVISION
MANUFACTURING COMPANY
CLEVELAND, OHIO

EATON® PRODUCTS: Engine Valves Tappets Hydraulic Valve Lifters Valve Seat Inserts Jet Engine Parts Hydraulic Pumps Motor Truck Axles Permanent Mold Gray Iron Castings Forgings Heater-Defroster Units Automotive Air Conditioners Fastening Devices Cold Drawn Steel Stampings Gears Leaf and Coil Springs Dynamatic Drives, Brakes, Dynamometers

To order these helpful booklets check the reply card opposite page 34.

What You Should Know About Air-Placed Concrete

67. For a detailed explanation of the principle of "gunned" or "air-placed" concrete and description of the improved Model 750 and 1250 Bondactors, be sure to get your copy of Form 553 from Air Placement Equipment Co., 1011 W. 24th St., Kansas City 8, Mo. Check the reply card today.

Sidecrane-Backfiller-Tamper, A Versatile 3-Way Machine

125. A 3-way machine, the Cleveland 80W, that is a backfiller, sidecrane and tamper is described fully in a 12-page Bulletin, No. L-102, available from The Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio. Design and construction features, photographs of the machine in operation and complete dimensions and specifications are covered. Check the reply card.

Heavy-Duty Pipe Cutter Works In or Out of Trench

164. Built to stand the most severe service, the all-purpose Ellis & Ford pipe cutter, for cast iron water mains 4" through 12", is easy to use in tight places, works in or out of trench. Full details on cutter and interchangeable parts in Catalog 39, available by checking coupon. Ellis & Ford Mfg. Co., Ferndale 20, Mich.

Restoration and Protection Of Concrete Structures

385. A "How to Do It" bulletin describing the Thoro System for repair and sealing interior and exterior masonry surfaces is available from Standard Dry Wall Products, Inc., New Eagle, Pa. The treatment for every water problem is presented in illustrated case histories in this useful publication.

One Man Field Tool Machines Any A-C Profile

475. Literature is available from Spring Load Mfg. Corp., 6332 Maynard Ave., Seattle 8, Wash., describing the Model B Spring Load A-C machinery and tapering tool. Also information on Spring Load A-C pipe cutters are included. Check the reply card.

Joint Materials and Sealers Described in Latest Literature

492. Fibre material, asphalt board, cold pour joint sealer, crack fillers and concrete curing compound are described fully in literature available from Presstite-Keystone Engr. Products Co., 3906 Chouteau Ave., St. Louis 10, Mo. Check the reply card for information on these paving and building products.

Principles of "BatchOmatic" Plants Explained

527. The unique principles of simultaneous and fully automatic aggregate and bitumen measuring followed on Barber-Greene's 2,000, 4,000 and 6,000 lb. "BatchOmatic" bituminous batch plants are explained with cut away drawings, charts and other illustrations in a 3-color bulletin offered by Barber-Greene Co., Aurora, Ill. Check the reply card.

Tracto-Loaders For Fast Material Handling and Excavating

600. Tracto-Loaders with capacities from ¼ cu. yd. to 1½ cu. yd. are described fully, in a 2-color catalog available from Tractomotive Corp., Deerfield, Ill. General purpose material handling and excavating loading in confined areas are jobs performed by these machines. Check the reply card.

Fifty Combinations of Matching Equipment For Case-Terra Trac Tractors

617. Dump loaders, angledozers, bulldozer blader, backhoes, mowers and scarifiers are several of the attachments available for the 40 to 100 hp Case-Terra Trac crawlers and industrial wheel tractors. For complete information on the attachments and tractors write J. I. Case Co., Racine, Wisc., or check the reply card.

Simplify and Save on Public Works Electrical Construction

710. Information and literature is available from Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa., on how you can simplify electrical details of a public works project. Westinghouse field specialists will help you plan the electrical system to fit your need. Check the reply card.

Make Blueprint Filing Easier and More Efficient

717. A blue print rack for engineering departments that is made of steel and is equipped with 12 plan holders is described in literature available from Momar Industries, 4323 West 32nd St., Chicago 23, Ill. Check the reply card for price list and the advantages of this easy to move and complete unit.

•

STREET LIGHTING AND TRAFFIC CONTROL

Engineering Data on Aluminum Lighting Standards

256. Latest designs and applications of all-aluminum, seamless, tapered lighting standards, traffic signal posts and elliptical lighting brackets plus detail drawings and mechanical specifications are provided in a comprehensive 16-page bulletin issued by Pfaff & Kendall, 84 Foundry St., Newark, N. J.

Engineering Guide to Mercury Street Lighting

380. Basic engineering aspects of mercury vapor street lighting are discussed in a 35-page Engineering Guide available from Westinghouse Corp., Box 2099, Pittsburgh 30, Pa. This practical reference includes technical data on mercury lamps applicable to general lighting service, operating characteristics of the system and a discussion of methods of economic evaluation of alternative lighting systems.

Valuable New Floodlighting Catalog

403. A 16-page catalog containing information on tapered steel and aluminum Monotube floodlighting poles designed for use in lighting outdoor sports activities, commercial and industrial areas and parking lots, has just been issued by the Union Metal Mfg. Co., Canton 5, Ohio. Easy-to-read diagrams, illustrations and applications are included. Check the reply card.

Bathey

SURVEY MARKING and IDENTIFICATION EQUIPMENT

BATHEY SURVEYOR STAKES AND IDENTIFICATION CAPS

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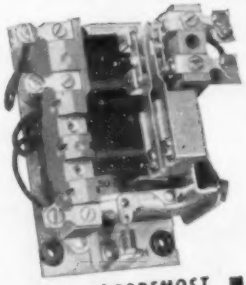
BATHEY MFG. CO.

100 S. MILL STREET PLYMOUTH, MICH.



- Catalog also covers Induction Relays, Relay Enclosures, Contactors and Starters, Multiple Pump Controls, Electrode Holders, Starter and Relay Combinations, Special Controls and Panels.

FIRST and FOREMOST IN THE FLOATLESS CONTROL FIELD

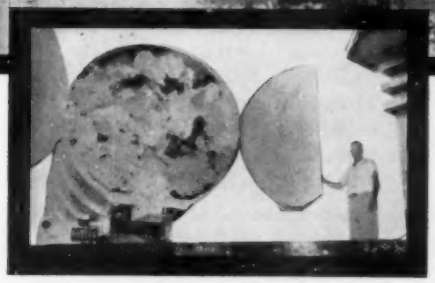
B/W CONTROLLER CORPORATION

224 E. Maple Road

Birmingham, Mich.

2

WHETHER YOU USE... *Sanitary Landfill or Incineration* PAK-MOR'S *designed to do a better job!*



JUST BACK RIGHT IN AT INCINERATOR.

PAK-MOR UNLOADS QUICKLY AND CLEANLY

Ask for a PAK-MOR Demonstration — so you can observe these proven features in operation on your own job. There's a PAK-MOR Distributor in your area who can show you how PAK-MOR can do a better job for you.

PAK-MOR OVERCOMES the problems of inclement weather and uneven terrain at the landfill and low overhead clearance at the incinerator because PAK-MOR does not have to tilt its body to unload. Just back right in — open the back doors and start the Packer Plate as in a normal packing cycle and the PAK-MOR completely unloads.

THERE'S NO PICKING A LEVEL SPOT to overcome excessive shift of gravity as in tilt-type bodies and there is no worry of capsizing. No extreme weight is pivoted on the rear wheels — and no back and forth jogging is necessary in the unloading operation.

AT INCINERATORS, if you can back in, you can unload with a PAK-MOR — because overhead clearance is no problem.

FOR OVERALL OPERATING EFFICIENCY — on the route or at the dump — PAK-MOR's definite advantages save you time and money.

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LOOP 13 & ROOSEVELT AVE. POST OFFICE BOX 6147 WA 3-4317 SAN ANTONIO, TEXAS
EXPORT DIVISION — TIFCO INTER-AMERICA CORP. P.O. BOX 13361 HOUSTON, TEXAS

Down to Earth

Here's a "down to earth" fact. From base details to pole tops, Monotube street lighting poles are engineered to the highest standards of quality, appearance and performance. No compromise!

You are assured of satisfaction *and* economy both today *and* "tomorrow".

For catalogs or specific engineering data, write to The Union Metal Manufacturing Company, Canton 5, Ohio. In Canada: The Union Metal Manufacturing Company of Canada, Limited, Brampton, Ontario.

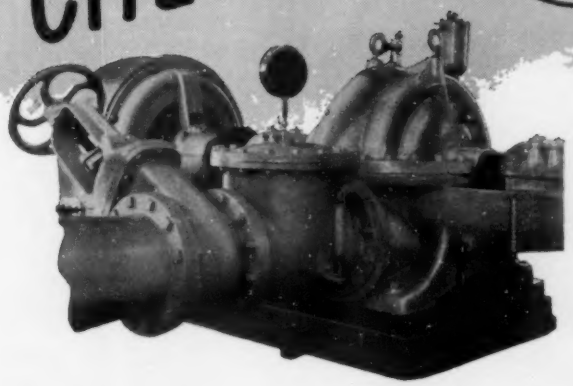
UNION METAL

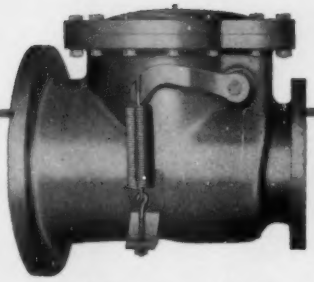
Monotube Lighting Poles

CLEARWAY—QUIET CLOSING

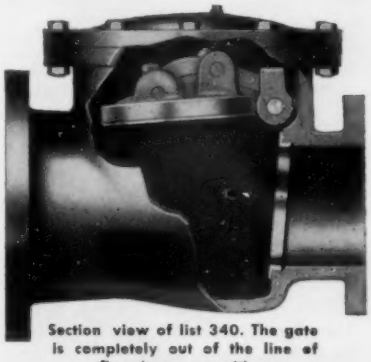
CHECK VALVES

RENSSELAER





List 340 Clearway, quiet closing check valve: increasing type with flange ends.



Section view of list 340. The gate is completely out of the line of flow in open position.

Low cost insurance against severe slam on pump shut down is provided in the Rensselaer clearway, quiet closing, non-slam check valve.

In operation, the gate is normally completely out of the line of flow and head losses are extremely low, even at high velocities. The lever arm and adjustable spring force the gate toward its seat on pump shutdown and the gate seats firmly at the instant of zero velocity, without slamming.

The List 340 Spring Check Valve may be installed in either horizontal or vertical pipe lines and is made in sizes up to 30 inch and pressures of 200 lbs. with flange ends only. Dual levers and springs may be provided for extreme conditions. All parts are readily accessible through the large removable cover.

The increasing type illustrated bolts directly to the pump discharge flange, eliminates increasers and saves valuable space. For locations where slamming is not anticipated, the Rensselaer list 37 without lever and springs is recommended. For higher pressures, the List 39 operates on non-shock cold water, oil or gas up to 400 lbs. W.P.

22

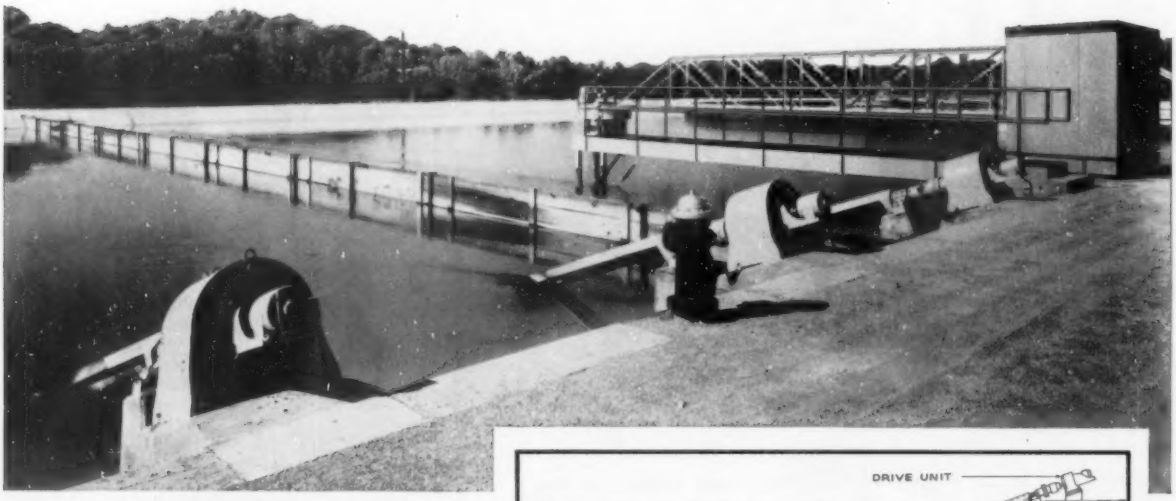
Ask for Bulletin "E"

LUDLOW & Rensselaer

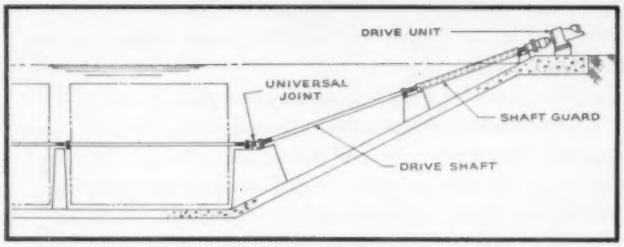
LUDLOW RENSSELAER **VALVES & HYDRANTS**

Since 1861 **THE LUDLOW VALVE MANUFACTURING CO.** *Troy, N. Y.*

unique FLOCTROL® drive
...new **JEFFREY** *design cuts costs 3 ways*



Three Jeffrey FLOCTROLS at St. Louis County Water Treatment Plant, St. Louis, Missouri, employ unique parallel-to-inclined-sidewall drive arrangement.



Jeffrey sanitary engineers designed the unique FLOCTROL drive shown above. Shaft runs parallel to the inclined sidewall of clarification basin and underwater universal joint is coupled to the horizontal FLOCTROL shaft. Drive shaft is protected at water surface by a steel guard which prevents fouling due to ice formation.

This efficient new Jeffrey FLOCTROL drive affords 3-way savings:

It is less expensive than drives of conventional design • Eliminates costly concrete and steel superstructures • Eliminates undesirable sprocket and chain drive through water.

Jeffrey FLOCTROLS are available in horizontal and vertical types. Horizontal units are usually installed in large plants, vertical units in smaller plants. FLOCTROL Systems eliminate short circuiting through the basin . . . provide tapered mixing for fast floc formation . . . permit 30% smaller basins than are customarily required.

For details on all Jeffrey equipment for water, sewage and industrial waste treatment, write for Catalog 905. The Jeffrey Manufacturing Company, 947 North Fourth St., Columbus 16, Ohio.

CONVEYING • PROCESSING • MINING EQUIPMENT...
TRANSMISSION MACHINERY...CONTRACT MANUFACTURING

JEFFREY

Extra Quality plus Extra Profit . . . that's what HELTZEL FORMS mean to me!

Says Leading Eastern Contractor

Heltzel Adjacent Curb Forms being set in place with a crew of two.

Heltzel Forms strip clean and easy cutting crew time to a minimum.

John Keelor, head of Keelor Construction Co., going over job blueprints with G. L. Finnen, Resident Engineer, and E. R. Hummell, District Construction Engineer.

"I've used all the popular makes of steel forms in my years in the construction business and I find the **Extra Quality** built into Heltzel Forms means **Extra Profits** right down the line," says John Keelor, head of the Keelor Construction Company, Pennsburg, Pa., one of the east's leading construction firms.

"Heltzel Forms are designed right, to go down fast and strip easy with a minimum crew. The stake pockets are situated where they should be to give maximum support without bowing. And, Heltzel Forms can take the punishment of everyday use without failing."

When next you're in the market for steel forms for any purpose, remember it costs no more to have the finest. Specify Heltzel Steel Forms and get the **Extra Quality that means Extra Profits.**

THE HELTZEL STEEL FORM & IRON COMPANY

10020 442 THOMAS ROAD WARREN, OHIO

Water *Flavor* Improved

Flavor is detected through a combination of the senses of taste and smell. Therefore, the problem of odor plays a very large part in the flavor of foods. Water is actually a food in that it is essential to human existence. From the viewpoint of health, water is important. Some doctors have advised that the normal individual should have a water intake of six 8 ounce glasses per day. Certainly such an intake would be greatly discouraged unless the water supply is wholesome and palatable.

The water odor problem has been solved with Aqua Nuchar Activated Carbon. Baylis* states: "All tastes and odors likely to be present in a water supply can be removed with activated carbon . . . We find a few statements in the literature on water treatment that the taste or odor was not removed by the addition of carbon, but almost invariably the reason was that not enough carbon was used."

If you are bothered by odors in your water supply, we will be happy to work in your plant and demonstrate how to render the water palatable. This service is rendered without cost or obligation on your part.

* John R. Baylis. Elimination of Taste and Odor in Water McGraw-Hill Book Company

GOOD CARBON · GOOD WATER · GOOD WILL

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230 Park Ave., New York 17, N. Y.
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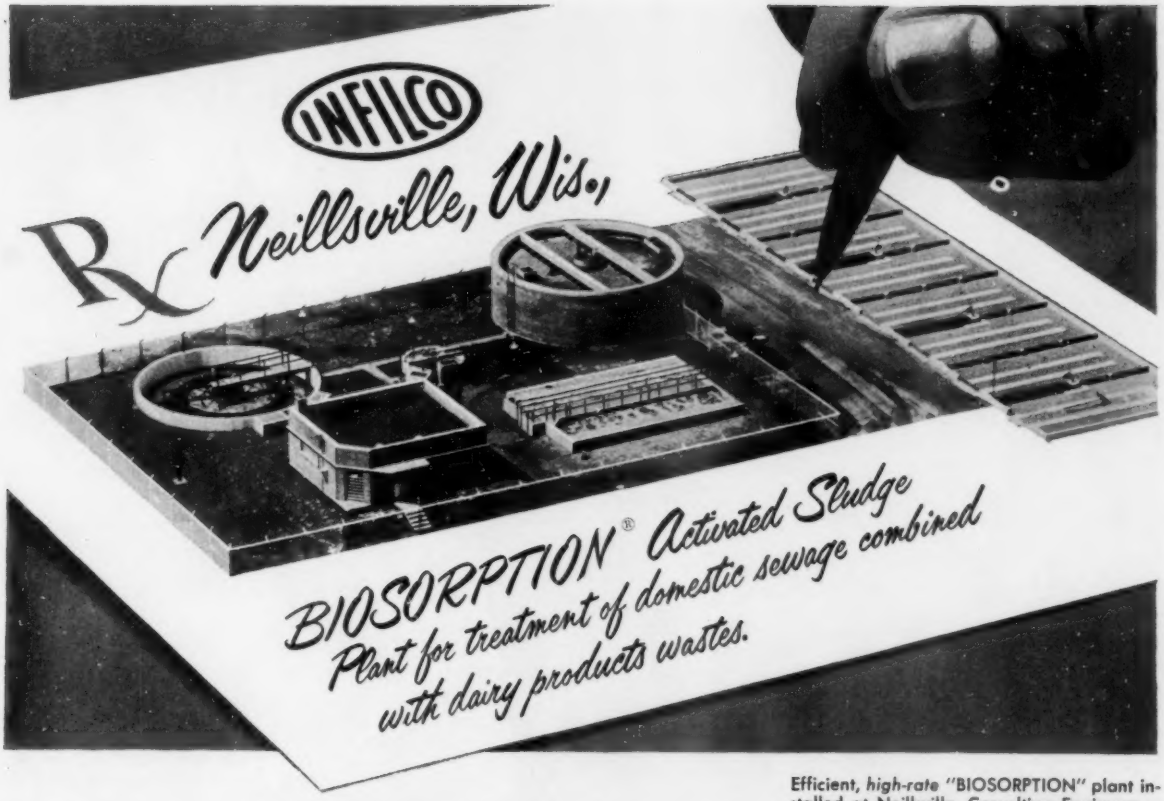


Efficient, *high-rate* "BIOSORPTION" plant installed at Neillsville. Consulting Engineers — Davy Engineering Co., La Crosse, Wis.

B.O.D. removal in half the space and half the time!

The PROBLEM: To provide 80% B.O.D. removal from domestic sewage and milk plant wastes combined as follows:

	G.P.D.	POP. EQUIV.	B.O.D. lbs.
Domestic sewage	278,000	3132	522
Milk plant #1	24,400	2658	443
Milk plant #2	39,800	2052	342
	342,200	7842	1307

The SOLUTION:

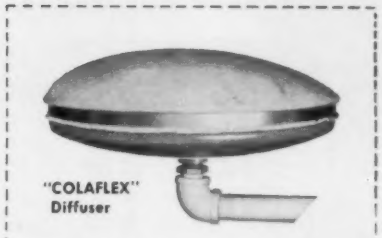
The "BIOSORPTION" activated sludge plant illustrated above was installed for maximum capacity in minimum space — highest efficiency at lowest cost. Equipment includes a CYCLATOR® clarifier combining mixing and clarification in a *single* basin; Stabilizer with 120 COLAFLEX® diffusers; GRIDUCTOR® comminutor, and digester.

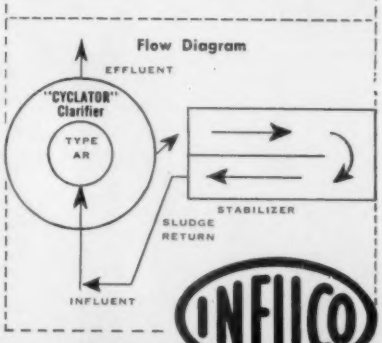
The RESULTS: Typical hourly samples composited for analysis:

1956 Date	Time	Ave. Flow M.G.D.	B.O.D. Raw Sewage P.P.M.	B.O.D. Percent Removal	Suspended Solids Raw Sewage P.P.M.	Suspended Solids Percent Removal
Nov. 21	9 A.M.-4 P.M.	0.262	1330	80.9	—	—
Nov. 27	8 A.M.-4 P.M.	0.226	741	83.7	366	78.2
Nov. 28	8 A.M.-4 P.M.	0.248	794	88.4	480	83.3
Dec. 3	8 A.M.-4 P.M.	0.232	642	80.5	508	84.2

If your problem involves greater capacity in *less* time — from *less* space — *at lower cost* — consult INFILCO because INFILCO KNOWS HOW to help you solve it. Write today for full information on this installation and Bulletin No. 6550.

Inquiries and samples are invited on all water, sewage and waste treatment problems.





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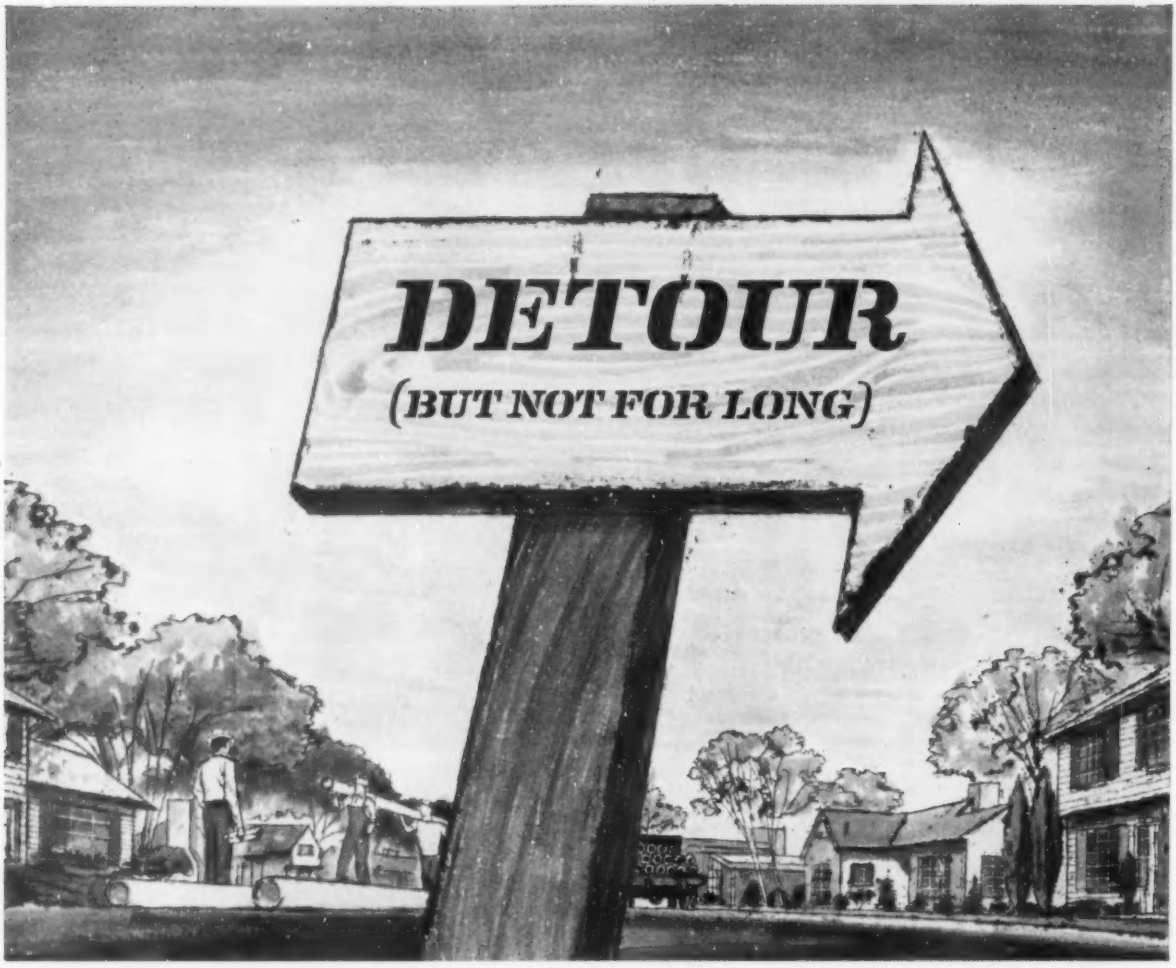
General Offices • Tucson, Arizona • P.O. Box 5033
Field offices throughout the United States and in foreign countries

THE ONLY COMPANY impartially offering equipment for ALL types of water and waste conditioning — coagulation, precipitation, sedimentation, flotation, filtration, ion exchange and biological treatment. 57423



Transite Sewer Pipe installs fast . . . to last!

. . . keeps installed costs lower . . . licks infiltration, root clogging

Transite's Ring-Tite Coupling prevents two major sewer line problems. It locks out roots . . . seals out ground water!

Its Ring-Tite Coupling is quickly assembled, provides a tight, long-lasting seal!

IN A SEWER PIPE INSTALLATION, you want a good "tight" system . . . and you want it completed fast! You get both of these advantages as well as long life and operating efficiency with Transite® asbestos-cement Pipe and the Ring-Tite® Coupling.

Why? Because lightweight Transite reduces handling costs, speeds work above and below ground. Quickly-assembled with the Ring-Tite Coupling, Transite Pipe ends are joined easily . . . *surely!* And to give you a tight long-lasting joint, rubber sealing rings in the Ring-Tite Coupling are tightly compressed between sleeve and pipe to lock out roots and overcome infiltration problems.

Another advantage of Transite Sewer Pipe is its smooth interior; its coefficient of flow is n=0.010. This results in substantial savings—lets you use smaller diameter Transite Pipe, or permits laying to flatter grades.

Let us send you booklet TR-165A. Address Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

Johns-Manville

TRANSITE SEWER PIPE WITH THE RING-TITE COUPLING

NEW (MB) SWEEPERS handle more jobs faster and ...easier

M-B Sweepers handle a variety of jobs in every season — jobs like cleaning dust, dirt and snow from streets, highways, sidewalks, playgrounds, driveways, intersections and parking lots; sweeping park lawns; and similar applications whenever a fast clean-up is necessary. There's almost no end to the many uses you can put these versatile units. Thoroughly engineered for most popular make tractors or tractor loaders.

New Hydraulic 2-Way Sweepers

Tractor-Mounted **Loader-Mounted**

New M-B 2-way sweepers are hydraulically driven and controlled — shift the broom 30° right or left of center for fast, *two-way* sweeping. Hydraulic pump may be installed for front drive or rear PTO mounting. Sweeper head bolts-up in minutes with snap couplings available for hydraulic hoses.

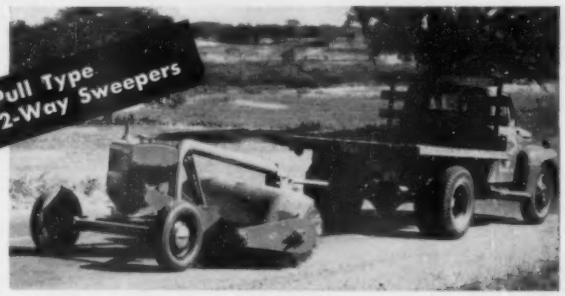
Floating action broom automatically adjusts broom pressure to surface contour; brush may be turned end for end for even wear; broom lifts 8″ off the ground; broom widths of 5′ and 6′; easily removable sweeper head; ball bearings throughout; guarded chain drives; and many other advantages. M-B Sweepers are also available with mechanical drive and hydraulic lift.

For complete information on the M-B Sweeper best suited to your needs see your tractor dealer, or write:

M-B CORPORATION
1611 WISCONSIN AVENUE
New Holstein, Wis.

Engineered to fit most popular make tractors — 5′ and 6′ broom widths — versatile year 'round use.

Complete hydraulic control for swing, lift and brush drive — easily mounts in place of bucket on tractor loaders.



Big, heavy duty units for highways, airports and similar big-capacity applications — 2-way sweeping — traction-driven and engine-driven models.

PACKER BODIES • LINE MARKERS • SWEEPERS • PAINTS AND BEADS
M-B CORPORATION
NEW HOLSTEIN, WIS.
MANUFACTURERS OF QUALITY
MUNICIPAL AND CONSTRUCTION EQUIPMENT SINCE 1907

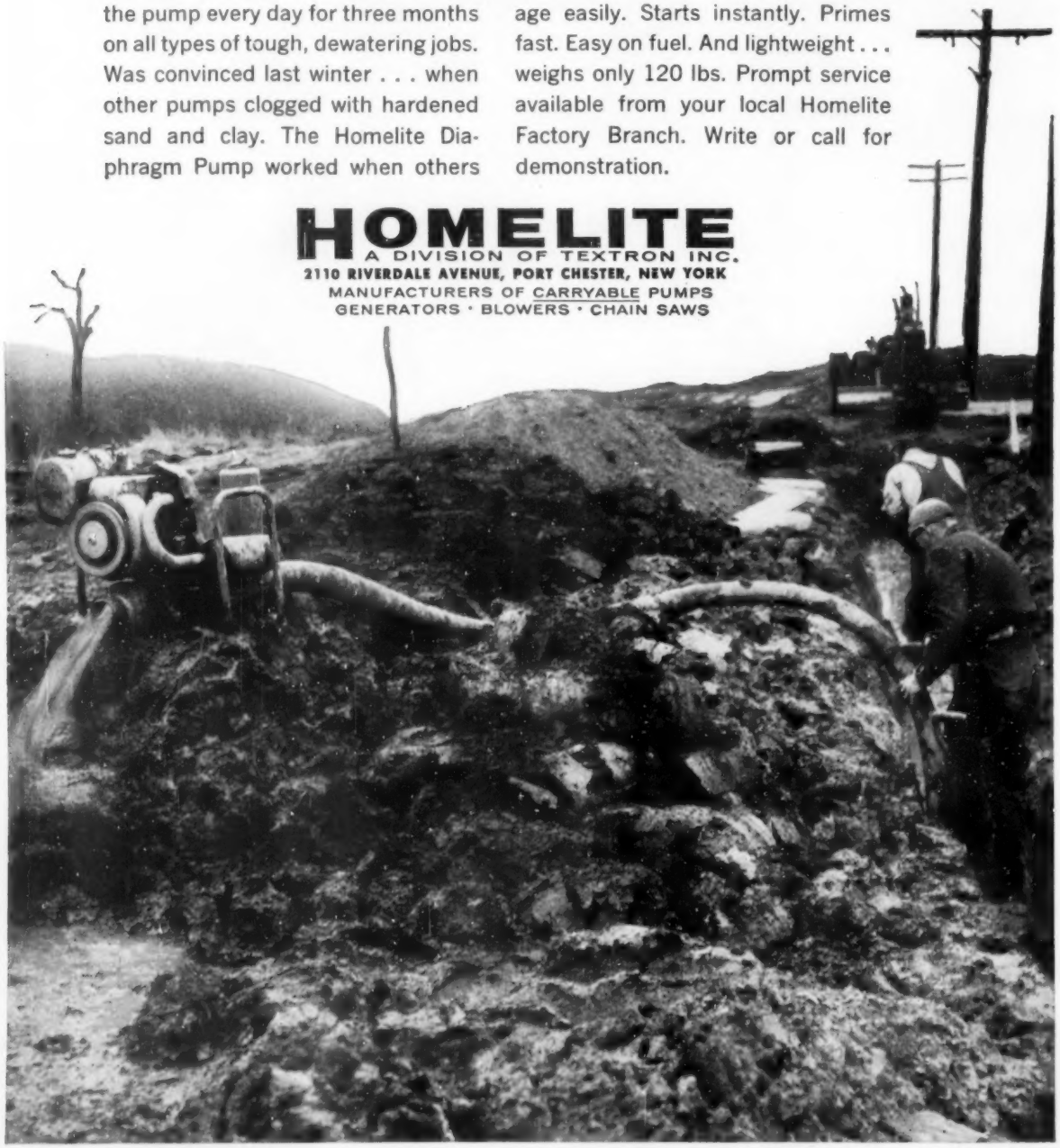
FOR MEN WHO BUY EQUIPMENT FOR WHAT IT SAVES

"Not one dime's worth of maintenance"

Mr. Joe Cloghessy, Pres.
T. F. Cloghessy, Inc.
Hammond, Ind.

That's this contractor's cost record with a Homelite Diaphragm Pump. Zero for maintenance . . . and he used the pump every day for three months on all types of tough, dewatering jobs. Was convinced last winter . . . when other pumps clogged with hardened sand and clay. The Homelite Diaphragm Pump worked when others wouldn't. Handles water thick with mud, sand, clay, gravel freely. Pumps 5,000 gals. per hour. Handles seepage easily. Starts instantly. Primes fast. Easy on fuel. And lightweight . . . weighs only 120 lbs. Prompt service available from your local Homelite Factory Branch. Write or call for demonstration.

HOMELITE
A DIVISION OF TEXTRON INC.
2110 RIVERDALE AVENUE, PORT CHESTER, NEW YORK
MANUFACTURERS OF CARRYABLE PUMPS
GENERATORS · BLOWERS · CHAIN SAWS



LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

Into the Gutter: A Savage Story

Savage v. Town of Lander, 309 Pac. (2d) 152, a Wyoming case decided April 2, 1957, was a suit by Myrtle Bell Savage against the Town of Lander, Wyoming, for injuries she sustained when she slipped through the inlet of a gutter drain which was broken.

In stepping into her car, she stepped off the curb into the street adjacent to the gutter drain inlet, and slipped "off something" and fell, with her leg extended into the inlet. Her leg was broken, and she suffered other injuries, and she brought an action for damages in the amount of $10,614.

The trial judge directed a verdict against the plaintiff, and she appealed to the Wyoming Supreme Court. The issues were whether the town was negligent, and if so, whether that was the proximate cause of the injury to the plaintiff.

Evidence was introduced to show that cars had been stuck in the hole, and of the grass growing up through the concrete. A former employee of the Town of Lander testified that the drain would freeze up in the winter, and said that "there was kind of a little dip place where water would stand there, kind of a drain to go into this thing underneath the curb, and they called it a drain".

The Supreme Court finally agreed that the directed verdict for the defendant had been correct. The Town had evidently been negligent, but the court said there was no proof whatever that this negligence caused plaintiff's injury.

Into the Ditch

Roberts v. City of Fairborn, 141 N.E. (2d) 297, an Ohio case decided Oct. 29, 1956, was an action by a pedestrian for damages when she fell into an open drainage ditch adjacent to a traveled portion of a gravel street.

A street light located close to the ditch had been out for a week to ten days. As a result, when the plaintiff walked along the street on the evening of May 5, 1953, she inadvertently deviated from the center of the roadway and fell into the unguarded ditch.

A jury awarded her $7500 damages, and the verdict was upheld on appeal.

Apparently, therefore, if you are going to fall into a drain, it is safer to do it in Ohio than in Wyoming.

A Moral Story About an Act of God and a Flood

State ex rel. Summers v. Sims, 97 S.E. (2d) 295, a West Virginia case decided Feb. 5, 1957, involved a mandamus proceeding to compel the State Auditor to make payments out of appropriations made by the Legislature for damages caused by the negligence of the State Road Commission in the construction and maintenance of a highway bridge. A total of $14,300 was involved, including property damage, personal injury, and wrongful death claims of three people.

Earlier, the Attorney General of the State had recommended to the Legislature the payment of these claims, and the Legislature had made an appropriation for their payment. But, upon presentation of the claims to the State Auditor, he refused to make payment on the ground that the State had no moral obligation to make such payments, since the damages were caused by an "Act of God", namely, a flood caused by excessive rainfall.

The people in question lived in a house in a valley, with a State Road on one side and Horse Fork Creek on the other. At the edge of their property, the road made a sharp turn, crossing the valley and the creek.

Complete Line of Homelite Carryable Construction Equipment Now Available

Self-Priming Centrifugal Pumps . . . Carry these lightweight, dependable pumps anywhere. Non-clogging design . . . 28 foot suction lift . . . capacities up to 15,000 g.p.h. . . . sizes from 1½" to 3". Diaphragm pump also available.

Chain Saws For Every Job . . . Now you can choose from a full line of lightweight, powerful Homelite chain saws. From 3½ to 7 horsepower . . . 19 to 29 pounds. Brush cutting and clearing attachments are available to handle all your cutting jobs.

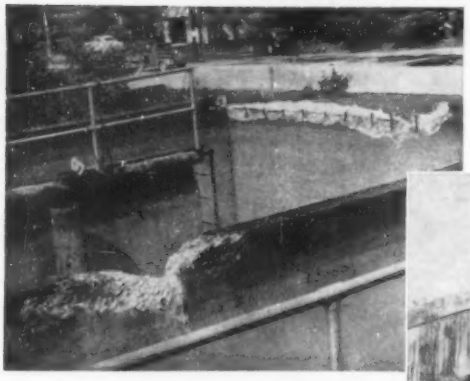
Carryable Gasoline Engine-Driven Generators . . . Lightweight Homelite generators can be carried and used anywhere to provide high-cycle and 115 volt power for your electric vibrators, tools, and floodlights. Complete range of sizes up to 5,000 watts . . . all standard voltages.

HOMELITE

a division of Textron Inc.

PORT CHESTER, NEW YORK

THOROSEAL *Restored* this Filtration Plant



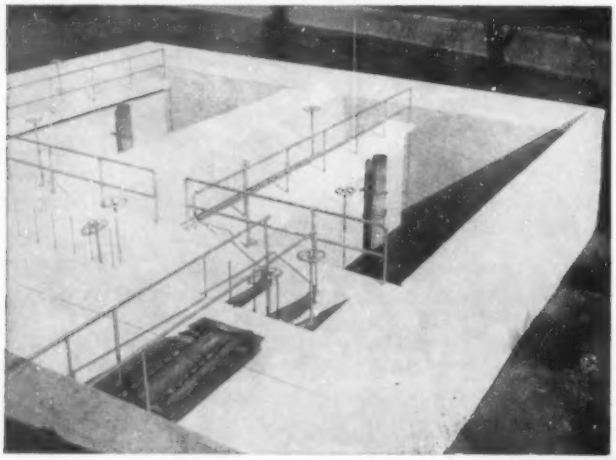
BEFORE

Example of complete break-down of masonry, due to penetration of water into body of concrete and action of frost in damp masonry.

It is amazing how THORO System products will correct a condition, such as shown in photograph. Concrete was sandblasted to remove all disintegrated material to sound concrete surface and reinforcing rods. Patching was done with THORITE Patching Mortar, bringing blistered areas to true and even lines, followed by two applications of WHITE THOROSEAL for protection.

AFTER

At minimum cost, almost ⅓ the cost of other methods, concrete restoration, patching and surface protection was completed with THORO System products on Filtration Plant in Keyser, West Virginia. Contractor: Standard Construction & Waterproofing Company, of Cumberland, Maryland.



Get our pictorially described literature "HOW TO DO IT"

STANDARD DRY WALL PRODUCTS INC.
NEW EAGLE, PENNSYLVANIA

In 1942, the State Road Commission built, about a hundred feet downstream of the house, a fill across the valley, as an approach to a bridge which it constructed across the Creek. The fill was 5-7 feet high, and the bridge was 34 feet long and 10 feet high and of wooden construction, with two end abutments pile-driven into the ground and a bent located approximately in the center with three or four poles set on a mud sill about a foot wide, and stringers laid from the end abutments to the center bent and three-inch boards laid on the stringers. As the state of repair of the bridge became bad, it became necessary for the State Road Commission to repair the bridge from time to time, and in so doing it placed additional supports between the end abutments and the center bent, thereby reducing the areaway for the passage of water beneath the bridge, causing the lodging of debris against the supports so as to create a dam in the stream.

On the night of June 16, 1957, there was a heavy rain in the drainage basin of Horse Fork Creek, and the stream was so flooded that it backed up around the house, and lifted it and the outbuildings from their foundations. The bridge washed out and the house was broken apart. Anna Summers and her two sons were thrown into the water, the mother was drowned, and the two sons sustained personal injuries.

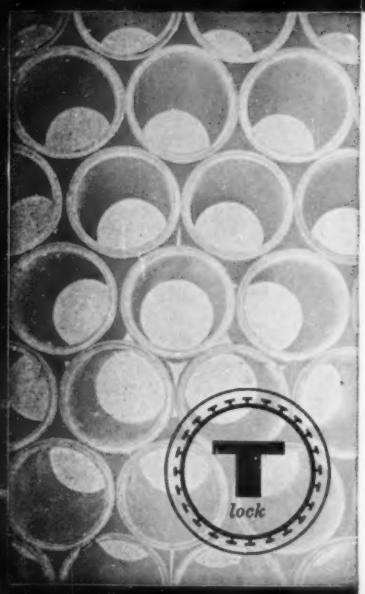
The Supreme Court of Appeals of West Virginia held that regardless of whether any "Act of God" occurred, the State Road Commission had been negligent, and a damage action would have been available against the State except for its immunity. Thus, there *was* a "moral obligation" to pay the damages, and it was so ordered.

• • •

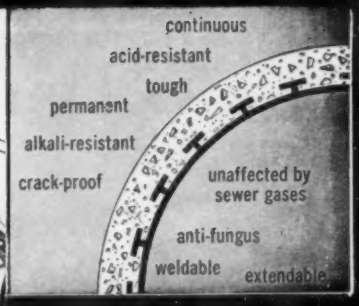
Report on Illinois State Toll Road

As of July 23, 1957, less than two miles of the Illinois Toll Road remained to be placed under construction contract. Total roadway and bridge construction awards for 185 of the 187 miles of toll highway together with the contracts awarded for supply of materials totaled $259,378,289. The revised estimates reflect a gross increase in project cost amounting to $82,519,662.

The resale of buildings, mostly residences, involved in the right-of-way of the tollways has resulted in salvaging a total of 362 structures at a return of $532,238.



T-lock® sewer lining prevents hydrogen sulfide attack...



Tunnels present no difficulty even when using collapsible forms.

MILLIONS OF SQUARE FEET NOW IN USE! T-Lock Amer-Plate permanently ends corrosion in concrete sewer systems—because it is impervious to hydrogen sulfide, other sewer gases, fungus, bacteria, acids, alkalies and salts.

T-Lock is an extremely dense, flexible, crack-proof liner of high polymer vinyl resin. Integral T-shaped ribs are permanently locked into concrete during pouring. Joints are heat-fused to form a continuous protective lining that will not separate from the concrete even under extreme back pressure.

Over 3 million square feet of T-Lock Amer-Plate have been installed in pre-cast, cast-in-place and monolithic sewer structures of all sizes with no sacrifice of structural strength — at costs comparable to earlier lining methods.

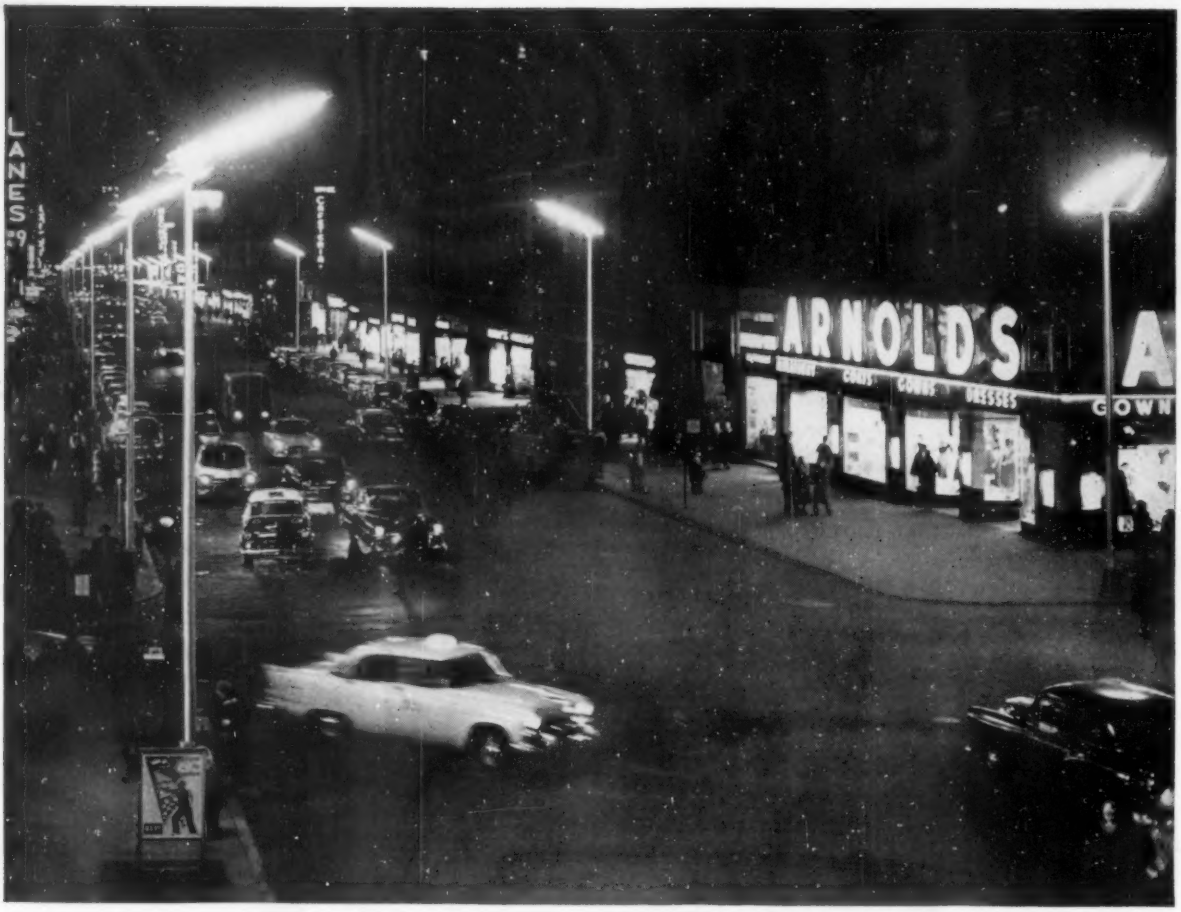
Illustrated brochure and list of typical installations on request.

Houston, Tex.
Jacksonville, Fla.
Kenilworth, N.J.
Evanston, Ill

Amercoat® CORPORATION, Dept. BJ
4809 Firestone Blvd., South Gate, Calif.

Readily adaptable to complex forms for cast-in-place structures.

T-Lock in place on inner form before pipe is poured.



New York City's "14th Street Association" proves modern whiteway lighting pays big dividends

With the use of P & K aluminum standards and LUXaire® Fluorescent Luminaires, the average light level on 14th Street, a major downtown shopping center, has been increased from 0.4 to better than 2 foot candles. The P & K LUXaire® units, specially designed in wedge shape, are mounted at 30-foot height on staggered 70-foot spacings.

The choice of P & K equipment, combining high strength with light weight, permitted the use of existing electrical vaults with a minimum of excavation and foundation work. Installation was quick, easy, and low in cost. Negligible maintenance requirements, a feature of all P & K products, will serve to keep the *real* cost of lighting equipment on 14th Street surprisingly low.

Comments from the 14TH STREET ASSOCIATION, who paid for the new lighting: "New White way has accomplished its purpose . . . business improvement . . . enhanced shopping area . . . safer for shoppers and vehicular traffic. . . ."

WRITE FOR A COPY OF THE P & K LUXaire® Catalog . . . and use the P & K planning and advisory services without obligation.

P&K PFAFF & KENDALL
84 FOUNDRY ST., NEWARK 5, N. J.

REX
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WASTE TREATMENT EQUIPMENT
CHAIN BELT COMPANY
Bulletin 315-92 Packaged Industrial Wastes Treatment
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Bulletin 315-81 Unitube Tow-Bro Sludge Remover
Bulletin 315-111 Why Industrial Wastes Treatment
Bulletin 54-82 Float-Treat System
Bulletin 315-22 Heavy-Duty Bar Screens
Bulletin 315-62 Sludge Collector Specifications
Bulletin 315-41 Grit Collectors
Bulletin 315-21 Front Cleaned Bar Screens

NOW AVAILABLE . . . for your reference library on waste treatment

The answer to your problem of municipal or industrial pollution, or waste reclamation, may be found in the new Rex Bulletin 315-11. This bulletin describes various methods of waste treatment and the CHAIN Belt quality process equipment available to perform these functions reliably and efficiently.

If your specific problem is sludge or scum removal from rectangular tanks, the new Rex Bulletin 315-61 describes in detail the proved Rex Conveyor Sludge Collectors and Skimming Equipment which will do the job in the best possible way.

You or your engineers will find these two new bulletins helpful in selecting waste treatment equipment.

For data on other Rex products for waste and water treatment, detailed bulletins are available. These bulletins will help you select and specify the proper equipment for the job...equipment designed and built in the CHAIN Belt tradition of quality engineering and manufacture. Many of these bulletins include engineering and selection data.

Complete your "reference library" today. Send the coupon for these new bulletins, or other bulletins, that can help you with your problems of waste treatment.

CHAIN BELT

Milwaukee 1, Wisconsin

CHAIN Belt Company
4722 West Greenfield Ave.
Milwaukee 1, Wisconsin

Please send the bulletins checked as follows:

☐ 315-11 "Waste Treatment Equipment"
☐ 315-61 "Conveyor Sludge Collectors"

☐ Others .....

Name.....

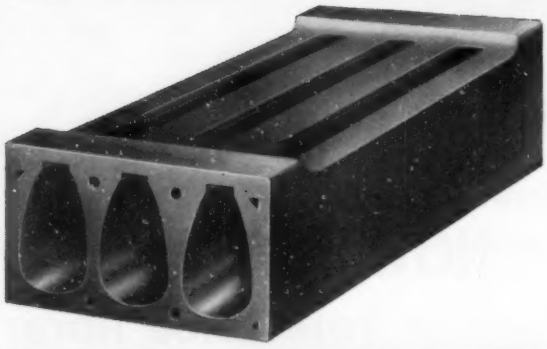
Address.....

City.....*State*.....

ACID RESISTANT ★ HIGH COMPRESSIVE STRENGTH ★ EASY TO LAY

Close-up view of filter bed showing filter media directly on top of Unifilter Block Underdrain Floor at Sewage Treatment Plant in Worcester, Mass.

NATCO salt glazed UNIFILTER underdrain BLOCKS

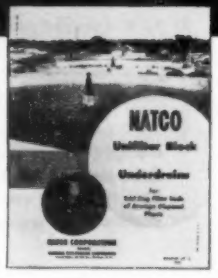


Whether it's strength, acid and corrosion resistance, durability, low absorption, rapid flow characteristics—NATCO UNIFILTER salt glazed underdrain blocks more than meet the requirements. They provide maximum drainage and ventilation capacity for either standard or high rate trickling filter sewage treatment plants. Moreover, they are easy to handle, easy to lay, and they are chemically inert and permanent in form.

These are more than claims—they are statements of fact based on records where NATCO UNIFILTER BLOCKS have been installed and are successfully performing . . . and that means in some of the largest sewage treatment plants in the world.

For best performance in Standard and High Rate Trickling Filter Sewage Treatment Plants

Send today for your copy of the Natco Unifilter story, complete with filter design details and data



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Natco Clay Products Ltd., Toronto

NATCO QUALITY CLAY PRODUCTS SINCE 1889

Exterior view, showing ash tunnel entrance at right center.

Truck ramp and spacious tipping floor outside storage bin.

for **OMAHA, NEBRASKA**

375 TONS PER 24 HOURS

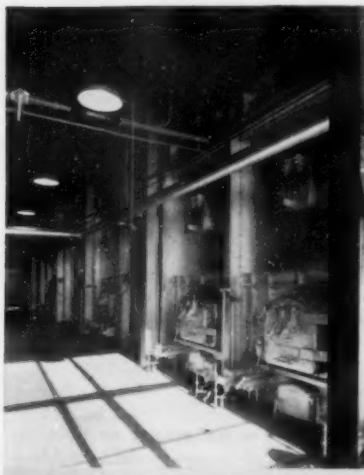
of efficient, odorless nuisance-free

INCINERATION

by

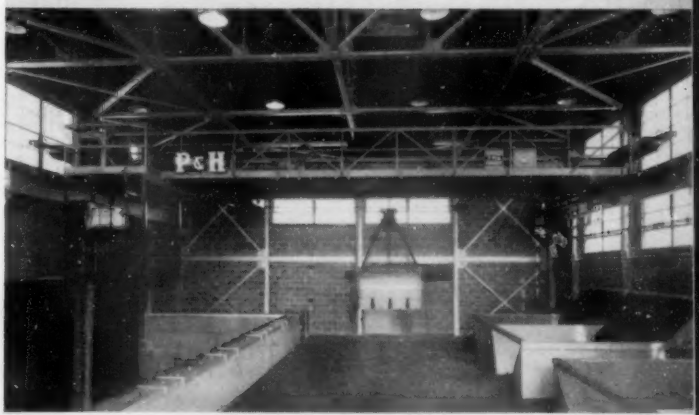
PITTSBURGH -DES MOINES

This compact, modern facility provides Omaha with the most advanced features in community refuse disposal at low comparative cost. Thanks to Pittsburgh-Des Moines mechanical stoking, high capacity is obtained with minimum manpower. Complete high-temperature incineration of all combustible material assures freedom from odor, fumes and dirt. Write for 24-page Bulletin 601, detailing the various PDM Incineration Plant types and advantages.



Stoking floor, showing hydraulic stoker controls.

Ash hoppers in drive-through tunnel.



Charging floor, storage bin and crane.

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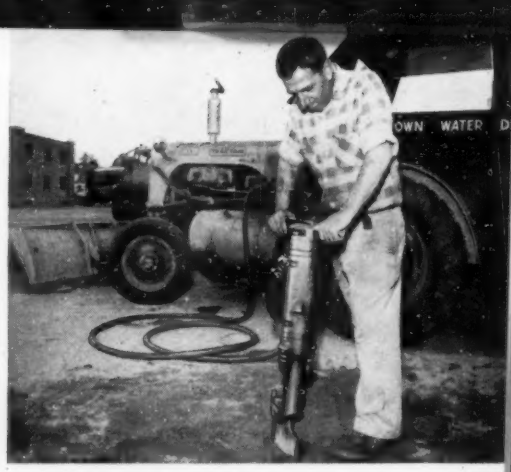


Here's complete water pipe repair service on wheels. In addition to clay-digger (shown), this Tractair 125 is equipped with a breaker, backhoe, front end loader, sump pump, and backfill blade.

How Tractair* Helps Lower City Water Rates

Self-propelled unit starts breaking ground anywhere in town in less than 20 minutes after leaving garage

Multi-purpose tractor-compressor provides on-the-job power for "start-to-finish" water-pipe repairs

"By using a tractor-compressor for power, we now repair broken water lines in just half the time it used to take," reports Water Superintendent Michael B. Oates of Watertown, Mass. "Fast repairs save money, and we pass on these savings in the form of low water costs." His department recently purchased their third consecutive Le Roi Tractair in the past 15 years for repair and maintenance of water lines.

He reports that the self-propelled Tractair can reach any point in town in 15 minutes, bringing all the necessary tools and attachments — and frequently the crew. Another 5 minutes for connecting air hoses and setting up, and repairs are under way.

Powers Several Tools

Tractair's 125 cfm capacity permits operation of several tools at the same time. For example, using 65 lbs. pressure, a Tractair-operated sump pump virtually drains the ditch dry, while the other outlet powers a breaker for baring the broken pipe section.

This feature, Oates adds, is "an important blessing. When we used two gasoline pumps, we could never keep the ditch dry, and we were forced to shut the water-gates for hours at a time. Now, with Tractair, we need to close the gates for only an hour, during the time we are working directly on the damaged pipe. That saves our customers the annoyance and possible fire hazard of interrupted water service."

Goes Right to Job

Superintendent Oates points out that Tractair's mobility brings compressed air right to the spot where it's needed, regardless of terrain. This, he explains, shortens hose lines and eliminates loss of air power.

In summarizing the many benefits, Oates told how self-propelled Tractair can be used on three or four different jobs during the day which "enables us to work about 60 ft. of street a day with two men, an operation that might otherwise, take five men a week, besides requiring additional pieces of equipment."

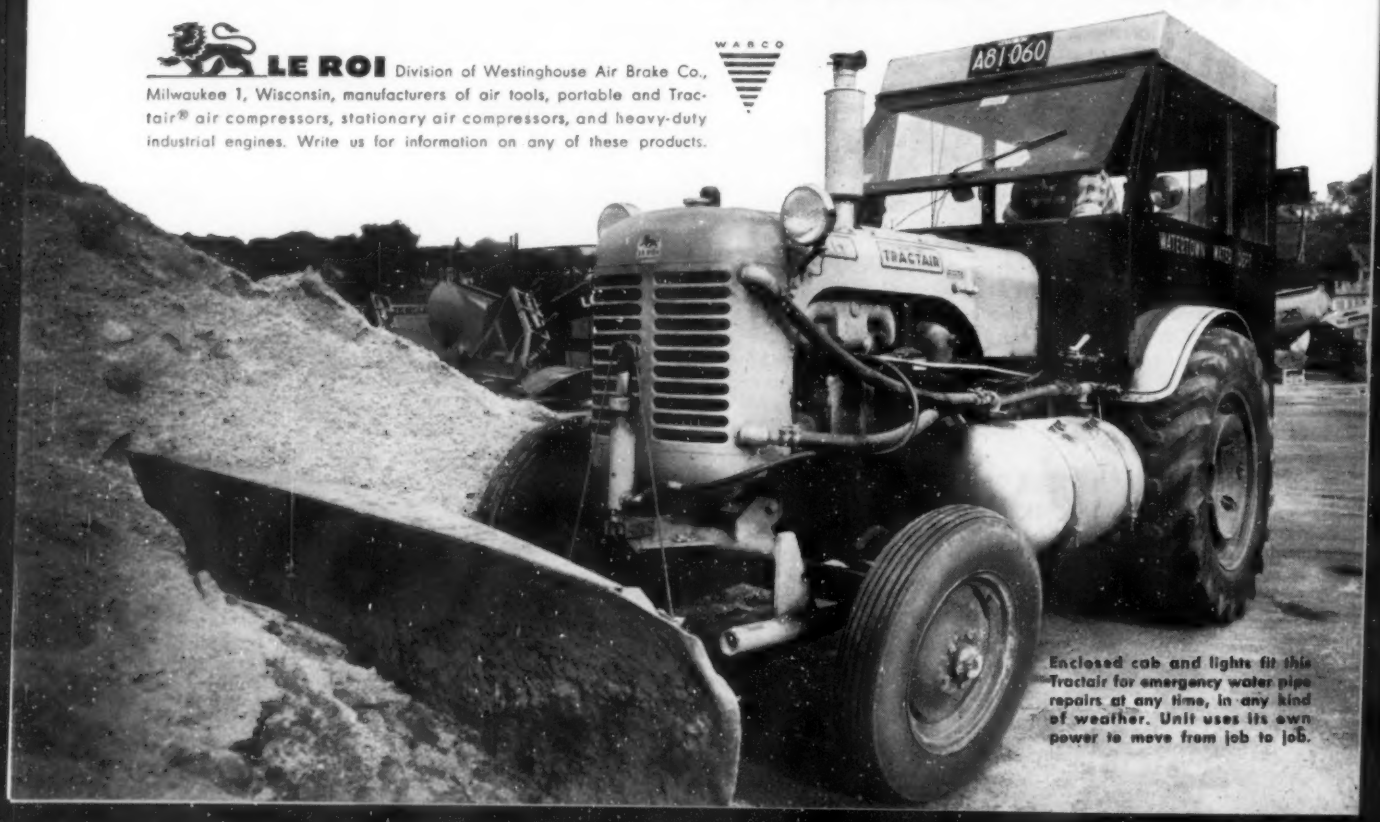
Upkeep is low, too. Total repair cost for the three Tractairs used consecutively during the past 15 years is only $500 — or $33 per year.

Tractair can give you the same low-cost, dependable service. Write us for further information.

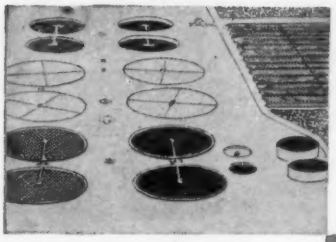
*"Tractair" is the registered trademark for Le Roi's combination tractor—air compressor.

LE ROI Division of Westinghouse Air Brake Co., Milwaukee 1, Wisconsin, manufacturers of air tools, portable and Tractair® air compressors, stationary air compressors, and heavy-duty industrial engines. Write us for information on any of these products.

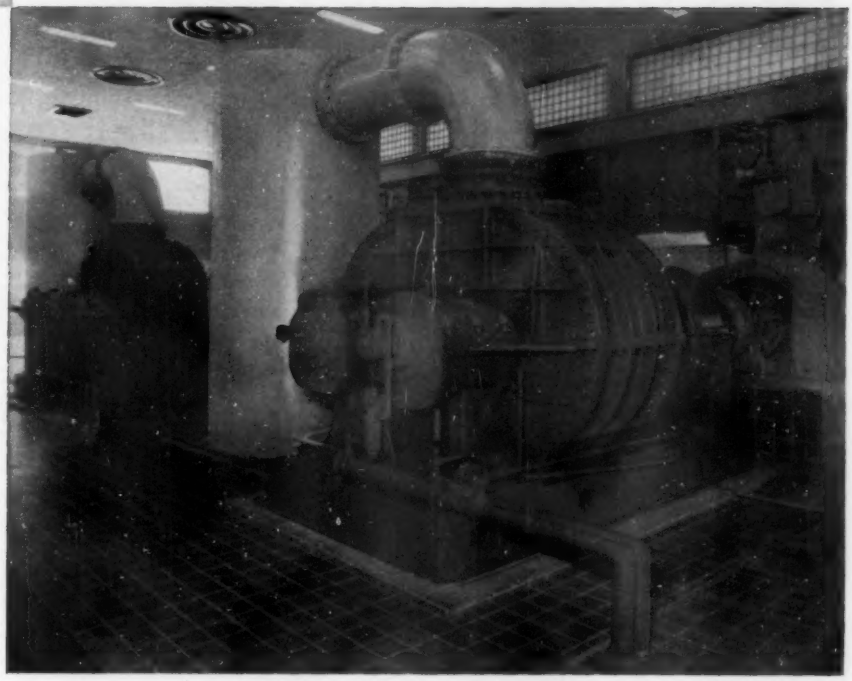
WABCO



Enclosed cab and lights fit this Tractair for emergency water pipe repairs at any time, in any kind of weather. Unit uses its own power to move from job to job.



For waste treatment



In the modern South Bend, Indiana sewage plant, two R-C Rotary Positive Blowers rated at 19,000 cfh, 7½ psig, 327 rpm, 735 Hp are direct connected to engines. Consoer, Townsend & Assoc.–Consulting Engineers.

R-C blowers give engineers these 7 design advantages

For sewage or waste treatment application, Roots-Connersville blowers offer maximum design freedom and flexibility.

- *Capacity range*–up to 25,000 cfm for pressure to 10 lbs in single-stage units. For larger volumes, R-C offers single and multi-stage centrifugal blowers.
- *Speeds*–higher speeds develop same cfm in smaller units, reducing weight, floor space, first cost.
- *Efficiency*–minimum slippage loss assures high volumetric efficiencies; constant volumes delivered regardless of pressure requirement.
- *Operating economy*–horsepower determined by actual operating pressure; minimum maintenance and downtime.
- *Drive flexibility*–may be direct-connected to electric motors or gas engines, and with V-belts or reduction gears.
- *Low friction*–negligible loss from surface friction, no loss from internal mechanical friction.
- *First cost*–smaller units save foundation and installation costs, satisfy strict budgeting.

For design information and specification data, ask for Bulletin RB-154 or call your Roots-Connersville Field Engineer.

ROOTS-CONNERSVILLE BLOWER

A DIVISION OF DRESSER INDUSTRIES, INC.

1057 Poplar Avenue, Connersville, Indiana. In Canada–629 Adelaide St., W., Toronto, Ont.

You will see Roots-Connersville Rotary Positive Blowers in operation on the official F.S.I.W.A. tour of the Nut Island Sewage Treatment Plant in Quincy, Mass.

78 cents per million gallons... pumped by Westinghouse

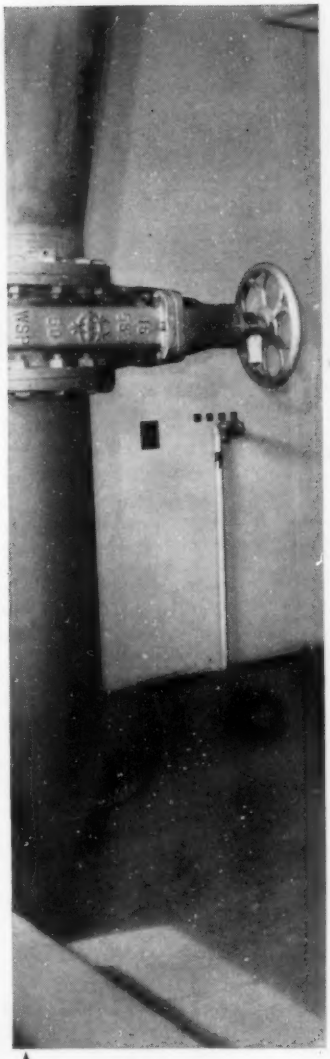
Basic operating cost of pumping stations in the Tacoma, Washington, sewage plant is of more than usual importance in the over-all plant cost because of an unusually high gallons-per-capita-day flow through the system. Engineers found it necessary to plan for nearly three times normal.

In the main pumping plant at Tacoma, four Westinghouse vertical pump motors handle the load. They are cut in and out as required and the sequence of rotation changed automatically. The station is unmanned except for periodic checks and maintenance by operators from the treatment plant.

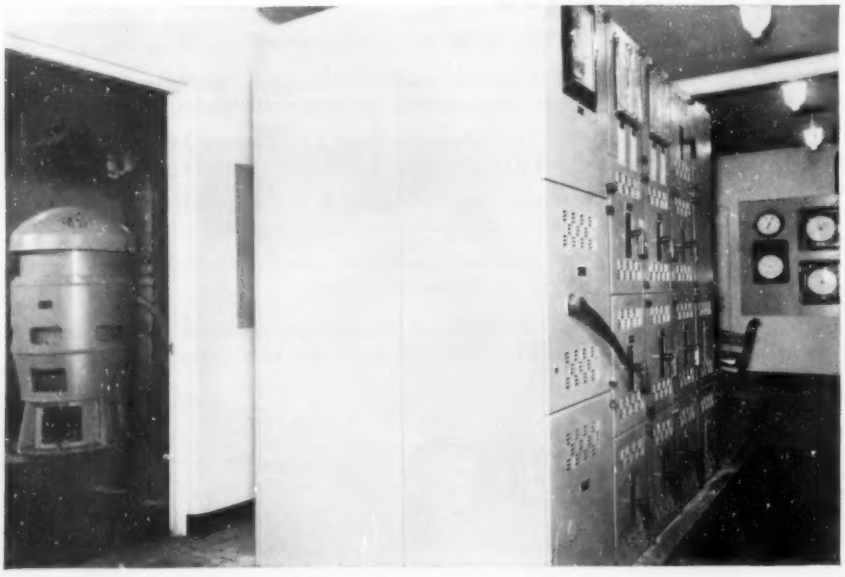
Although the pumping requirement is high in proportion to the population served (about 67,000) the actual pumping cost is not. Yearly costs in the Tacoma plant average about 78 cents per million gallons of sewage pumped. Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. J-94075

YOU CAN BE SURE...IF IT'S

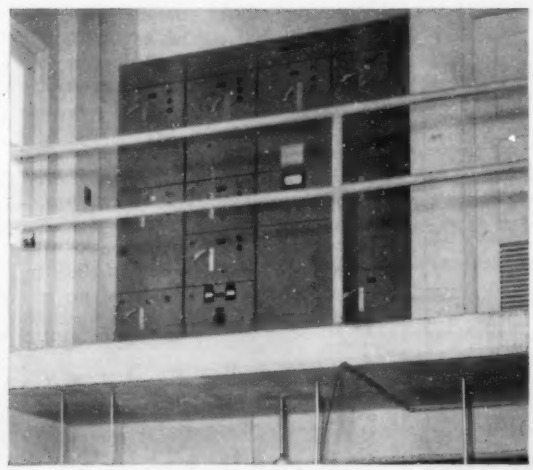
Westinghouse



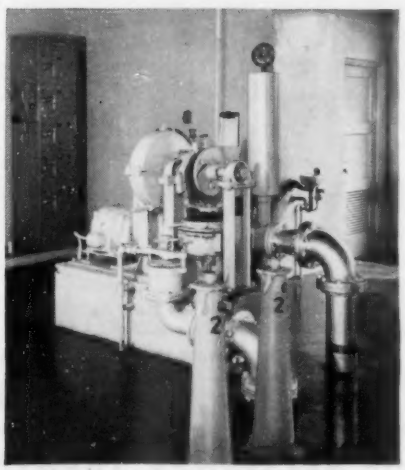
The four Westinghouse vertical pump motors in the Tacoma plant—4000 gpm, 50 hp; 8000 gpm, 100 hp; 10,000 gpm, 100 hp; 12,000 gpm, 125 hp.



Distribution of power to motor and lighting circuits for the entire plant is through this Westinghouse switchgear, located in the main pump building.



Control center for many of the sewage plant motors, located on a balcony to conserve space, is typical of the Westinghouse unitized equipment which simplifies sewage plant electrical construction.



This Westinghouse motor drives one of the many pumps in the treatment plant. Note convenient location of control unit for this and other adjacent motors.

Veteran operator Delbert Corman "at ease" while his Cleveland is digging gas and water lines for a Lexington, Ky. subdivision

Cleveland's exclusive multi-speed transmission provides right power/speed ratio for every job

"For easy handling and dependable digging even under the toughest trenching conditions give me a Cleveland every time," says long-time heavy equipment operator Delbert Corman of Aldridge & Poage Co., Lexington, Ky., owners of 3 Clevelands. Thousands of trench operators and owners throughout the world agree with him. Credit for this world-wide preference for Clevelands is due to the perfectly balanced combination of practical performance-proved features found in every Cleveland. Practically every modern trencher feature originated with Cleveland. But no single trencher feature ever developed is the equal of Cleveland's exclusive multi-speed crawler transmission.

For *each* of 4 digging wheel speeds this transmission provides 12 individual crawler speeds forward and 12 reverse, all closely and evenly graduated. The 48 forward speeds give the operator a choice of over 30 *practical* digging speeds—over 30 usable *combinations* of digging wheel and crawler speeds, providing the *right* combination of power and speed for digging every soil, under every digging condition. The following table of non-slipping, power-saving digging speeds for the Cleveland 95 is typical.

Cleveland's exclusive multi-speed transmission has no equal

For each of 4 wheel speeds	there are 12 individual crawler speeds											
With Main Transmission (and Digging Wheel) in	SPEEDS (in Feet per Minute) — Available in Either Direction (Bold Face Indicates Most Commonly Used Digging Speeds)											
First Speed	.5	.7	1.1	1.5	2	2.8	3.4	4.7	5.9	12.6	22.5	38
Second Speed	1	1.4	2.2	2.9	3.9	5.3	6.6	9	11.5	23.8	43	73
Third Speed	2	2.8	4.3	5.8	7.8	10.6	13.3	17.9	22.8	47	86	146
High Speed (Ordinarily used when digging)	3.3	4.6	7.1	9.5	12.8	17.5	21.7	29.6	38	78	143	240
Reverse (not used when digging)	.4	.6	.9	1.2	1.6	2.2	2.7	3.7	4.8	9.9	18	30

THE CLEVELAND TRENCHER CO.

20100 ST. CLAIR AVENUE • CLEVELAND 17, OHIO

Good Everywhere

OPPORTUNITIES and PERSONAL NEWS

Opportunity in Engineering

Applications will be received through Nov. 1 for the position of Utilities Engineer by the Personnel Department, City of Phoenix, Phoenix, Ariz. An outline of responsibilities, qualification requirements and other pertinent data will be found on page 197.

• • •

LYNN M. MILLER has joined the staff of Jones, Henry & Williams, consulting engineers of Toledo, O. Mr. Miller served with the Water Resources Section of the Michigan Department of Conservation for the past eight years as assistant chief.

CHARLES T. TENCH, retired colonel of the Corps of Engineers, U. S. Army, has been placed in charge of Louisiana and Texas operations for Palmer & Baker, Inc., Consulting Engineers. His headquarters will be in New Orleans.

• • •

Engineer's Club of Hartford Is Organized

A short time ago 47 employees of The Metropolitan District of Hartford, Conn., organized an Engineer's Club. The Club is made up of employees in Engineering and Technical Class fications engaged in the various duties of Water Purification, Distribution, Heavy Construction, Sewage Disposal and Regional Planning. The membership has grown to 100 out of a potential of 129 employees in the classification from engineering aide to executive.

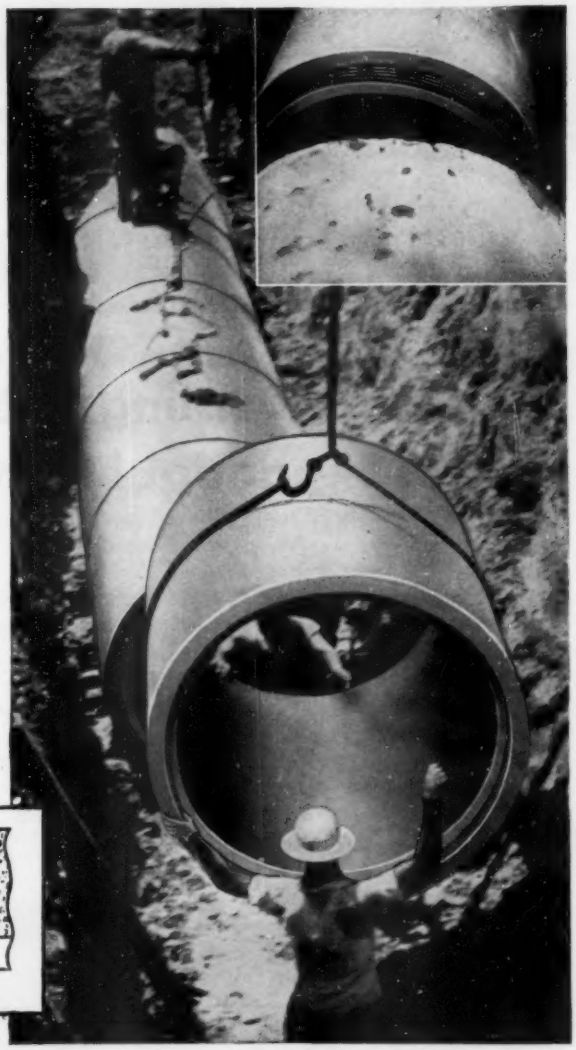
The purposes of the Club's formation, stated in the by-laws, are as follows: (a) To sponsor professional and/or technical seminars, lectures, educational and informative meetings, and the like, with member participation; b) to sponsor research and/or collection of data by members and associates of an engineering nature and the dissemination of the same, with professional writing encouraged; c) to study such other matters as will be of general benefit to the membership and/or the District; and d) to sponsor social activities.

Meetings are held once a month at Hartford or within the District's far-flung field of operations. Secretary is A. E. Kuras, 115 Broad St., Hartford 2, Conn.

No one wants to DIG UP a sewer line . . .

THIS ONE IS "LEAK-PROOFED FOR LIFE"* WITH

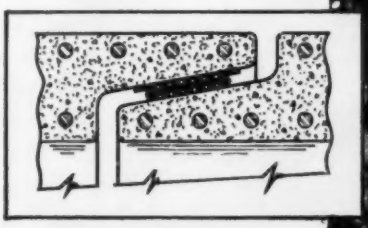
TYLOX *flexible* RUBBER PIPE JOINTS



This sewer line in *CORPUS CHRISTI, TEXAS won't have to be dug up in a few years because of leaky or failing joints! In specifying TYLOX Rubber Gaskets, engineers and city officials took advantage of a coupling material **known** for its non-deteriorating, ageless qualities . . . for its ability to make sewerage and drainage pipe joints leak-proof and root-proof for the life of the pipe itself.

But that's not all . . . along with the certainty of permanently water-tight pipe joints, their TYLOX specification assured faster construction and lower job costs. **Flexible** TYLOX is quickly assembled to the pipe, and permits fast assembly of the line. It compensates for pipe angularities . . . permits wet trench jointing . . . immediate backfilling.

TYLOX is the **one** pipe joint that meets the requirements of engineers, sanitary officials and construction men alike. Specify TYLOX on your pipe jobs.



This rubber-tight seal STAYS tight "for the life of the line".

5032

HAMILTON KENT MANUFACTURING COMPANY

KENT, OHIO

427 West Grant St. Orchard 3-9555

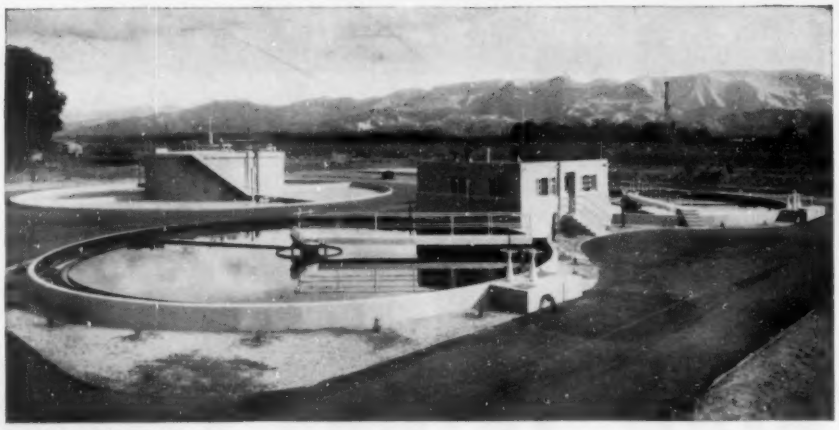
* **PROJECT:** 48" trunk sewer for City of Corpus Christi, Texas

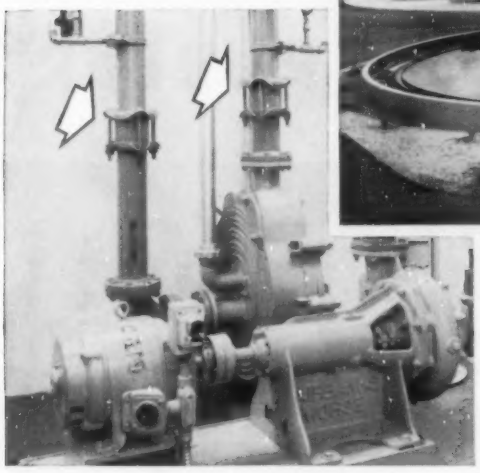
ENGINEERS: For City of Corpus Christi, Texas — Drahn Jones, Dir. of Public Works, and Klyde Z. Huston, Engineer

CONTRACTOR: Heldenfels Bros., Corpus Christi, Texas

PIPE: TYLOX-Jointed, reinforced concrete, furnished by TexCrete Company, Corpus Christi, Texas

PLANNING FOR
THE FUTURE





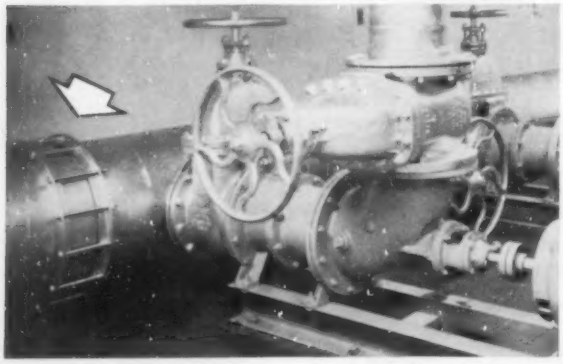
Dresser Couplings insure efficient leakproof performance in the vital piping system of this modern sewage treatment plant at Fillmore, Calif.

Dresser Couplings on the sludge feed and discharge lines of this heat exchanger made this unit easy to install and easy to service whenever necessary.

Dresser Couplings Help Fillmore, Calif., Build Expandable Sewage Treatment Plant

When the city of Fillmore, Calif., recently completed construction of its modern sewage treatment plant, Dresser Couplings and steel pipe helped solve sewage handling problems not only for the present, but also for generations to come.

The new plant serves a growing community of 5,000, has a present capacity to serve 7,500, and is designed so that its capacity can be doubled, for a moderate additional investment, when future growth of the city requires it.



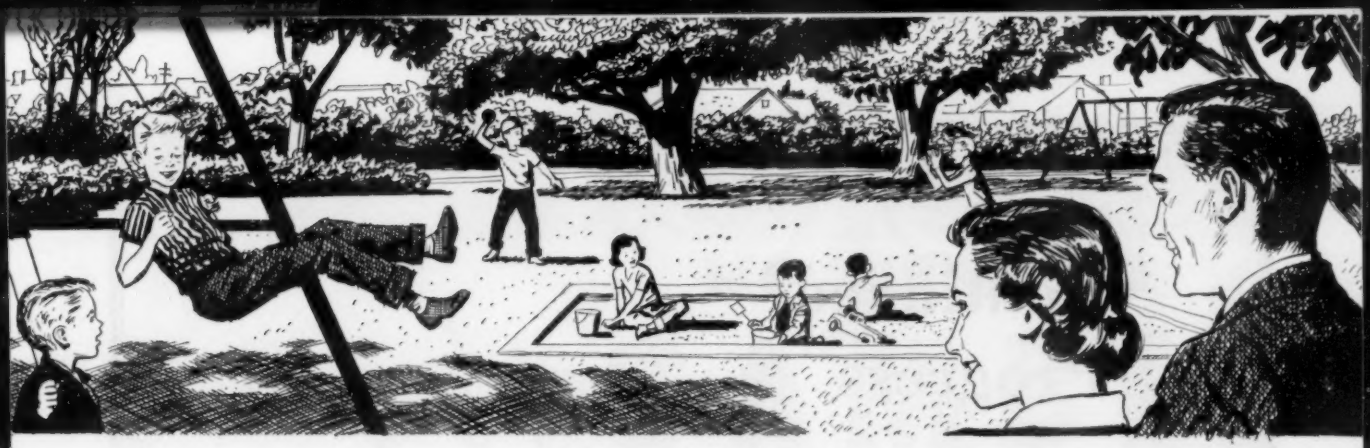
Dresser 24" Coupling provides a permanent, leakproof seal on this line leading the clarifiers to the biofilter.

The present single-stage plant can be expanded to a two-stage plant with double the capacity, by the addition of only one clarifier, one biofilter, and one new sludge digester.

Bennett Engineering Co., designers and builders of the new plant, made good use of Dresser Couplings in assembly of the plant's adaptable piping system. James D. Parsons, partner in the engineering firm, says: "We have used Dresser Couplings for the last 20 years. We have found them to be reliable, easy to install and easy to maintain."

A wrench is the only tool needed to make a permanent, leakproof joint with Dresser Couplings . . . no welding, threading or flanging is necessary. The couplings absorb vibration from pumps and equipment. Dresser Couplings are available in a complete range of sizes from ⅜" through 72" and above, from your local piping supply distributor. For complete information about Dresser Couplings for water, sewage, and industrial waste projects, write: Dresser Manufacturing Division, Bradford, Pa. Sales offices in: New York, Philadelphia, Chicago, S. San Francisco, Houston, Denver. In Canada: Toronto, and Calgary.

ONE OF THE DRESSER INDUSTRIES



Playgrounds assured...

but what about their most precious possession...water?

Protect your community's water and future...with Badger Meters

Recreation facilities are an asset to your community. That's why you willingly allocate funds for their expansion. But what about water supplies? They're *vital* to community existence. Yet many communities are retarded in their growth because there just isn't enough water for expansion.

You can start conserving water and insure your community's future *now*. With Badger Meters, every consumer is assessed fairly for water used or wasted. This fair-share, fair-pay plan stops water waste . . . assures future supplies for community growth. And when water waste stops . . . conservation begins.

Precision-engineered from the finest alloys for lasting, dependable efficiency, Badger Meters put your water system on a profitable business basis. Whether your system requires disc, turbine or compound meters—you can choose the right type from the complete Badger Meter line—in sizes from ⅝ in. through 12 in. Ask your Badger Meter representative for facts — or write for literature *today*.

Badger Water Meters

Water is vital

Badger Meters have conserved it better for over 50 years

BADGER METER MFG. CO. • 2371 North 30th Street
Milwaukee 45, Wisconsin • OFFICES IN PRINCIPAL CITIES

Continued Progress

BUSINESS continues as usual for us; the heavy pace has not subsided, and our Coilfilter continues to be applied on a relatively nation-wide basis for the dewatering of sanitary sludges.

In reviewing the year's work, three important features stand out vividly.

First, the matter of optimum operating vacuum for dewatering of this class of sludges has been firmly established through research by our own laboratory, and has been determined to be on the order of 12″ Hg. Paralleling our work were the efforts of Coackley and others who independently came to the same conclusion.

Second, in the course of equipment development we have reached the position in which we now manufacture all of the specialized auxiliaries for the Coilfilter installations ourselves. This was found to be necessary not only from an operating standpoint but as a point of rendering top-notch service to the Operators of the plants. These auxiliaries involve mainly the chemical feeders and pumps, having design features well in advance of what is available in standard lines.

Third, we are pleased to see repeat orders come to us through the recommendations of our Consulting Engineer friends. Engineers who have chosen our equipment through the years have come to realize the quality of our equipment and service; we note that one office has now used 14 Coilfilters in 8 years. Again, we wish to express our appreciation for the share of work we have been permitted to do during this most successful year.

Respectfully,
T. R. Komline

KOMLINE-SANDERSON
ENGINEERING CORPORATION
MANUFACTURERS OF THE COILFILTER
PEAPACK, NEW JERSEY

AMERICA'S LARGEST WATER AND SEWER MAIN CLEANING CONTRACTORS AND SPECIALISTS

NO NEED TO GAMBLE

CONTACT . . . THEN CONTRACT WITH THE *ONLY* PIPE CLEANING ORGANIZATION THAT CAN GIVE YOU THIS

IRONCLAD GUARANTEE

HERE'S HOW WE CAN DO IT!

1. NPRC's specially designed and patented POWER-RODDER has no equal for cutting through the most tightly clogged obstacles. The cleaning head is a double-edged auger attached to 1200 feet of continuous spring steel rod that cuts its way through anything.

2. Each NPRC executive and foreman have had vast on-the-job experience meaning lower costs and faster service for you.

3. NPRC knows its business . . . hundreds of testimonials from municipalities, industry, golf courses, public service companies and others verify this fact. Many municipalities and firms employ NPRC on a regular yearly maintenance contract basis to ensure full capacity flow at all times.

GUARANTEE

If we can't unplug your clogged water mains or sewer systems—NOBODY CAN! Your job is fully guaranteed or there is no charge for our service.

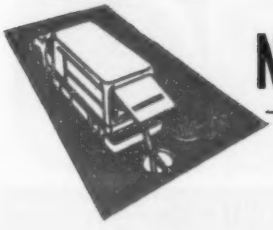
Harold S. Rudich
President

NATIONAL POWER RODDING CORP.

GUARANTEE

GET FREE ESTIMATES AND SURVEYS *NOW* . . . NO OBLIGATION, OF COURSE . . .

CALL COLLECT, WIRE OR WRITE



National Power Rodding Corporation

1000 SOUTH WESTERN AVENUE · CHICAGO 12, ILLINOIS
PHONE MOnroe 6-7700

MULCH LEAVES WITH A WOOD'S ROTARY

- Mows grass, shreds brush, mulches leaves
- 12 Models... for every tractor
- Quick detachable, free-swinging blades
- Trouble-free, simple construction
- Costs less to buy and operate
- All working parts enclosed

MODEL 80 (61 similar)

End leaf disposal worries forever... with the fast, clean cutting Wood's Tractor Rotary. The Model 80 takes nearly a 7-foot swath... up to 4 acres an hour. Cuts close to buildings, trees and fences—saves costly raking and burning. Maneuvers easily around roadside ditches and banks. Ideal for large acreage brush shredding, grass and weed control. More dependable and less expensive than reel-type or sickle bar machines.

Wood's Rotaries are adjustable from ground up to 14" height (most models). V-belt drive and free-swinging blades absorb shock loads, protect both machine and tractor. Blades are quick-detachable and overlap for cleanest cutting. 15" drop-center wheels or 8" with non-pneumatic tires. Models 80, Offset 80, 61 and 114 have brackets for remote control hydraulic cylinder.

12 Models... 42" to 114" cut. 42" undermounted for Farmall Cub, Lo-Boy, Super A, 100, A-C G, M-H Pony and Pacer. 42" rear-mounted for Fast Hitch Cub and Lo-Boy. 61" and 80" rear-mounted for Fast Hitch Farmalls Super C, H, M, 200, 300, 400, I-300 (all use 3 pt. adapter), and all standard 3-point hitch tractors (Ford, Ferguson, Oliver Super 55, etc.). 61", 80", and 114" drawbar pull-types for any 2, 2-3, and 3-4 plow tractors. 80" offset model (2-3 plow) for working under trees.

S

Send for Complete Information

WOOD BROTHERS MFG. CO. 18710 South 4th Street OREGON, ILLINOIS

Super De Lavaud

APCO

CAST IRON PIPE

In sizes 3" to 24" in modern long lengths. Bell and spigot, roll-on-joint and mechanical joint.

For water, gas and sewage.

Inquiries invited to our nearest sales office:

122 South Michigan Avenue, Chicago 3, Illinois
350 Fifth Avenue, New York 1, New York

ALABAMA PIPE COMPANY

General Sales Office
ANNISTON, ALABAMA

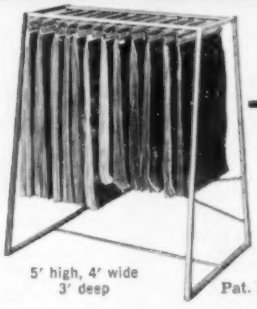
Holds 1800 Blue Prints

for *QUICK* filing

Glider

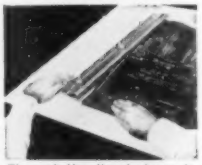
BLUE PRINT FILE

for: CONTRACTORS, ENGINEERS ARCHITECTS, DRAFTSMEN FACTORIES

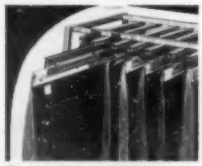


5' high, 4' wide
3' deep

Pat. Pend.



Through the direct clamp design of plan holders, you slip sheets, either singles or sets, in or out without removing others.



Plan holders "glide" in on steel tracks, are secured from end-to-end, and "glide" out with little effort.

Created for savings in filing space, time and effort, Gliders are available for print widths of 20" to 48". Gliders obsolete peg-type filing and hole-punching.

Your prints "glide" into place. Plan holders are retained from end-to-end, with no chance of bending or springing. Eye-easy indexes provide you with rapid reference.

All-steel Gliders, finished in a handsome grey, harmonize with modern office equipment. Extensions are available.

For longer print "life" and for efficiency, durability and economy in vertical filing, specify Glider. Order now through the best office suppliers or write for illustrated literature.

MOMAR INDUSTRIES 4323 West 32nd St. Chicago 23, Ill.

"Finest Improvement in History of Lindsay"

. . . that's how Mayor W. D. Stephens summarized the improvement in cleanliness and public health at LINDSAY, Okla., following installation of the DEMPSTER-DUMPSTER SYSTEM. You read about the official response from city officials and civic response from the LINDSAY NEWS in our September issue advertisement. Now we present the container-by-container breakdown at LINDSAY showing how your city, too, could take advantage of the cost-saving and public health benefits provided by one truck-mounted Dempster-Dumpster serving many big rat-proof, fire-resistant Dempster-Dumpster Detachable Containers!

From the Smallest to the Largest, cities all over America are reducing refuse collection costs and increasing sanitation with the DEMPSTER-DUMPSTER SYSTEM! To name a few — TUSCALOOSA, BOSTON, LUBBOCK, RALEIGH, HEREFORD, GRAND PRAIRIE, NORFOLK, LEXINGTON, BALTIMORE, ATLANTA, CINCINNATI, McALLEN, NEW YORK CITY. A survey of your commercial refuse problem may be arranged without obligation by writing to us now. *Manufactured by Dempster Brothers, Inc.*

7. MILLER FORD and entire block, survey showed, could be served by one Dempster - Dumpster Container.

6. RENEAU'S HARDWARE CO. and south half of this block served by the sixth Dempster - Dumpster Container.

5. HARDY FURNITURE CO. and north half of this block disposes of its refuse and garbage in this Dempster - Dumpster Container.

8. FIRST NATIONAL BANK and south half block served by this one.

4. GOODNER'S SUPER MARKET and south end of block.

9. OKLAHOMA TIRE & SUPPLY CO. and north half of block disposes its refuse in this container.

3. LINDSAY AUTO SUPPLY and center of block.

10. STEPHENS GROCERY and south half of block uses this Dempster - Dumpster Container.

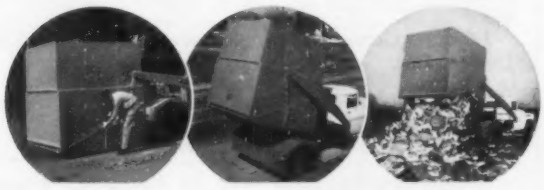
2. FLORENCE DRESS SHOP and north end of block is served by this Dempster-Dumpster.

11. LINDSAY - CRUSE DEPARTMENT STORE and north half block uses the eleventh container.

In addition to these, other containers not shown on aerial view of Lindsay are located at GEARIN'S SUPER MARKET, PRATT'S GROCERY and at shopping centers, outlying stores and apartment areas.

1. LINDSAY NEWS and entire block is served by this Dempster-Dumpster Detachable Container.

12. NORTHCUTT CHEVROLET and entire block served by this Dempster - Dumpster Container.



PICKS UP HAULS DUMPS

DEMPSTER BROTHERS, 9107 Dempster Bldg., Knoxville 17, Tennessee

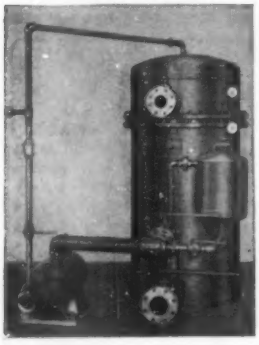
Beautiful Silver Thatch Inn, on Pompano Beach, Florida, offers its guests this lovely pool with underwater picture windows.

YES, here's another distinctive pool with the popular Adams Poro-Stone filters. More and more public pools are insisting on Adams Filters, and there are many good reasons why. Here are two of the important ones.

First, the exclusive ADAMS HI-FLOW backwash design gives you simple and easy cleaning . . . no messy disassembly . . . no scrubbing of filter elements. The high air dome and unrestricted backwash outlet provide complete purging of the filter tubes with high velocity water.

Second, rugged 4¼" O.D. PORO-STONE elements with nearly 40% open area are unaffected by corrosion. The first Adams swimming pool filter — in use since 1938 — was the first Poro-Stone Swimming Pool Filter installed in this country.

There are numerous other reasons why it pays to specify and buy Adams SPF filters. Get all the facts by writing for your copy of Bulletin 625. Use the Handy coupon below.



R. P. ADAMS CO., INC.

228 East Park Drive
Buffalo 17, N. Y.

This Adams SPF-129 Poro-Stone Filter keeps the Silver Thatch Inn pool water brilliantly polished for the enjoyment of swimmers and viewers alike. It offers 129 square feet of filter area . . . will handle pools up to 185,000 gallons capacity. It is ideally suited for outdoor pools such as is shown above.

R. P. ADAMS COMPANY, INC. O-57
228 EAST PARK DRIVE, BUFFALO 17, N. Y.

Please send me by return mail your new Bulletin 625.

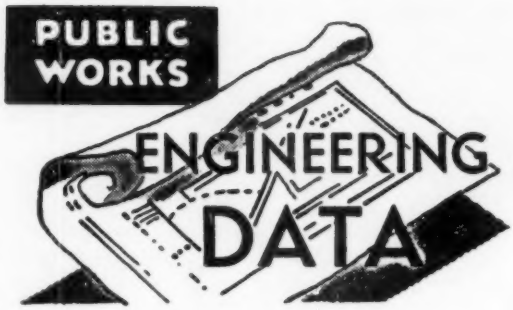
Name..... Title.....

Business.....

Street.....

City..... State.....

Size of pool is..... gallons.



Weight of Refuse Collected by Packer-Type Trucks

There are 112 packer-type refuse collection vehicles in use by Cincinnati, O. Ralph Taylor, Sup't. of Waste Collection, tabulates the weight collected by each size of vehicle. Of the 112 units, 20 are 16-yd.; 36 are 15-yd.; 19 are 13-yd.; 11 are 12-yd.; and 26 are 9-yd.

During 1956, the 9-yd. units collected 4686 loads having an average weight of 6,450 lbs.; the 12-yd. units collected 2350 loads with an average weight of 6630 lbs.; the 5157 loads in 13-yd. units averaged 6790 lbs.; the 9583 loads in 15-yd. packers averaged 7430 lbs.; and the 6329 loads in the 16-yd. units averaged 7770 lbs.

There were monthly variations, as are to be expected. The monthly averages for the 16-yd. packers ranged from a low of 6290 lbs. in January to a high of 8150 lbs. in August, which was about typical of the variations encountered. The 13-yd. units are considered most advantageous for existing conditions in Cincinnati.

It is interesting to note that the 16-yd. units averaged 316 trips each; the 15-yd. units averaged 266 trips; the 13-yd. trucks 271 trips; the 12-yd. vehicles 214 trips; and the 9-yd. 180 trips each.

Water Production and Use in Salem, Ore.

Because of summer water needs, Salem, Ore., has a very high water requirement during certain months. In 1956, the maximum daily production of water was 504 gals. per capita per day, compared with 521 gals. in 1955 and 442 gals. in 1954. Average consumption for 1956 was 164 gpcd; and for 1955 158 gpcd. The percentage of unaccounted for water is rather high, being 25.16 percent in 1956 and 25.04 percent in 1955.

The population served is about 45,000. In 1956, 59.0 percent of the total revenue came from residential consumers who used 40.2 percent of the total consumption. Commercial users consumed 27 percent of the water and contributed 23.7 percent of the total revenue. Industrial users consumed 26.1 percent and paid 12.4 percent. Overall irrigation requirements were small.

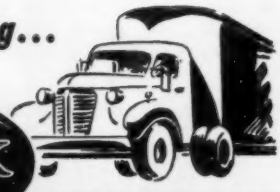
John L. Geren is Manager of the Salem Water Department.

Chicago's Five-Year Plan for Water Improvements

An ambitious plan to keep its fine water works system up to the needs of Chicago has been developed cooperatively by the Department of Water & Sewers and the Department of Public Works and

Keep 'Em Flying...

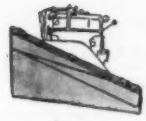
Keep 'Em Rolling... with the

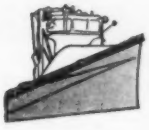


FRINK

ROLL-OVER SNO-PLOW

Rotates from Left to Right Hand Plowing Position IN 15 SECONDS





On runways and thruways, modern time tables depend on fast, efficient snow removal. The Frink Roll-Over Sno-Plow fills this need . . . works full plowing time because it can be reversed from left to right position in 15 seconds! No deadheading! Hydraulic controls in the cab quickly reverse the plow to throw all the snow in the direction dictated by the wind and disposal area location. On dual highways, the Roll-Over can discharge left, yet travel with the traffic.

This unique plow, with curved, tapered moldboard, operates safely at high speed . . . throws and spreads snow to eliminate high banks and subsequent drifting. And when the job is done, quickly and economically, the Roll-Over parks upright within its truck's width. For full details, write to Frink for catalog.

Other dependable Frink Sno-Plows (V-Type; One-Way and Reversible) can all be attached to the Roll-Over's lifting device assembly.

For Snow Plow Know-How It Pays to Think of FRINK SNO-PLOWS

Clayton, 1000 Islands, N. Y.
Frink Sno-Plows of Canada, Ltd., Toronto, Ontario

...for straight right-angle cuts every time...the new RIDGID Wide-Roll Pipe Cutter

fast true pipe cuts on your power drive

Rolls are twice the usual width, double the bearing surface on pipe—sure straight start of cut . . . by hand or power drive—extra fast and easy. Pays you to see it before you buy your next cutter—at your Supply House.

No. 201, ⅛″ to 1¼″
No. 202, ¼″ to 2″

The Ridge Tool Company, Elyria, Ohio, U.S.A.

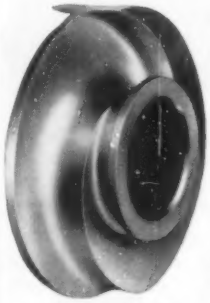
RIDGID Work-Saver Pipe Tools

You'll hear a lot about

MONO-VANE

SINGLE PASSAGE IMPELLER

the New NON-CLOG PUMPS "by Aurora"



PATENT PENDING

AVAILABLE HORIZONTAL or VERTICAL

The BALANCED Impeller may be trimmed — to suit other heads and capacities — yet REQUIRES NO SEPARATE COUNTERBALANCE

●

UNSURPASSED for HANDLING LONG STRINGY SOLIDS

●

EXCELLENT NON-OVERLOADING CHARACTERISTICS

●

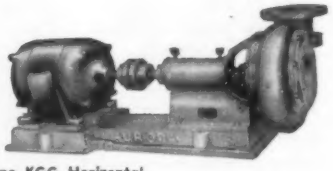
IDEAL FOR ELEVATING SEWAGE — PUMPING SLUDGE — HANDLING SETTLEABLE SOLIDS, EFFLUENT and OTHER WASTES

Aurora's exclusive MONO-VANE IMPELLER represents a major advance in the technique of non-clog pumping. Can be trimmed to various diameters — REQUIRES NO SEPARATE COUNTERBALANCE because it is in dynamic and hydraulic balance — therefore a wide range of operation. Built to Aurora's notable standards of quality for efficiency, long trouble-free service and economy. WRITE FOR BULLETIN 121-MV.

A COMPLETE LINE OF AURORA NON-CLOG PUMPS

— of conventional types are available to meet every situation. We'll gladly send you BULLETIN 121-A.

Aurora Type KU Vertical MONO-VANE Non-Clog Pump



Aurora Type KGG Horizontal MONO-VANE Non-Clog Pump

ENGINEERS

PUMPS "by Aurora" include pumps for every need in industry. Acquaint yourself with this distinguished line by requesting our CONDENSED CATALOG — a guide to the comprehensive line of Aurora centrifugal and turbine-type pumps. Aurora enables you to specify with confidence.

Your Inquiries Will Command Prompt Attention

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY

89 LOUCKS ST. • AURORA • ILLINOIS
EXPORT DEPARTMENT — Aurora, Illinois — Cable Address "NYABINT"

approved by the Department of City Planning. The total cost for the 5-year program is estimated at $157,214,000.

Included are new tunnels and shafts to cost $15,500,000; filtration plants to cost $84,210,000, including the Central District plant with connecting tunnels which are estimated to cost $79,010,000; pumping stations to cost $14,542,000; and main construction at $42,562,000. The latter item includes feeder mains 16 to 54 ins. in diameter, totalling $23,266,000; and small main extensions and miscellaneous work at $19,296,000.

Water Supply Tunnel in Detroit River for Wayne County

Plans for the intake structure in the Detroit River and for the 4-mile raw water tunnel have been completed by Parsons, Brinckerhoff, Hall & MacDonald.

The four-mile long tunnel is comprised of one mile of tunnel in rock under the Detroit River and three miles of land tunnel in clay. The rock bore will be made, about 100 to 150 feet below the bed of the river, by usual rock tunneling methods, and will be lined with concrete to an inside diameter of 12 feet. The land tunnel will be shield-driven, under compressed air, about 20 to 50 feet below ground level, and also will be concrete lined to a 12 foot inside diameter.

The intake, of heavy concrete construction, will be approximately 60 feet by 150 feet by 70 feet high. It will be founded on bedrock about 28 feet below the bottom of the river channel; and will be located in the main flow of the river in 30 feet of water. The 14 foot shaft of the intake, served by ample ports, will be connected to the river tunnel, deep in the bedrock below. The construction of these facilities will begin this fall.

Technical Institute Gives Two Years of Training for State Highway Personnel

The North Carolina State Highway Department has made approximately $15,000 worth of equipment available to the Gaston Technical Institute, Gastonia, N. C., for the opening of its newly-organized, two-year civil technology course which began this fall. The Institute is operated by North Carolina State College.

Faced with a shortage of engineering technicians, the Highway Department appropriated funds for the purchase of surveying equipment, such as transits and levels, as well as laboratory testing apparatus for concrete, soils, and bituminous materials.

In addition to the Highway Department's needs, the civil technology course will provide trained personnel for the construction and steel fabrication industries of the State. Among the topics covered in the civil curriculum will be estimates, cost, standard methods of testing and control, contracts and specifications, performance characteristics of construction equipment and construction methods.

The new Gaston Technical Institute program, operated by the State College School of Engineering as a part of the College Extension Program, offers an academic program to prepare high school graduates for positions as engineering technicians. In addition to the civil program, the technical institute will provide training in the fields of electricity, electronics, and mechanical and production technology.

BIG

CONCRETE PIPE BY AMERICAN-MARIETTA

American-Marietta 144" reinforced concrete pipe installation used by Ohio Edison Co. for a triple discharge line over 1000 feet long at Stratton, Ohio.

A-M trucks delivering concrete pipe directly to the job site. Nationwide location of plants assures quick delivery of your order by truck, rail or barge.

Another example of
PROGRESS IN CONCRETE

BIG diameter reinforced concrete pipe—delivered to the job in quantity—calls for a manufacturer with BIG facilities. American-Marietta not only has the necessary equipment and engineering background to produce such pipe in quantity, but the ability to deliver it *when* and *where* needed from any of its many plants located strategically from coast to coast.

So if you're thinking BIG—about a BIG job with BIG savings in time and money—think of AMERICAN-MARIETTA COMPANY.

Our technical staff will be pleased to assist you with your pipe problems.

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CONCRETE PRODUCTS DIVISION
GENERAL OFFICES:
AMERICAN-MARIETTA BUILDING
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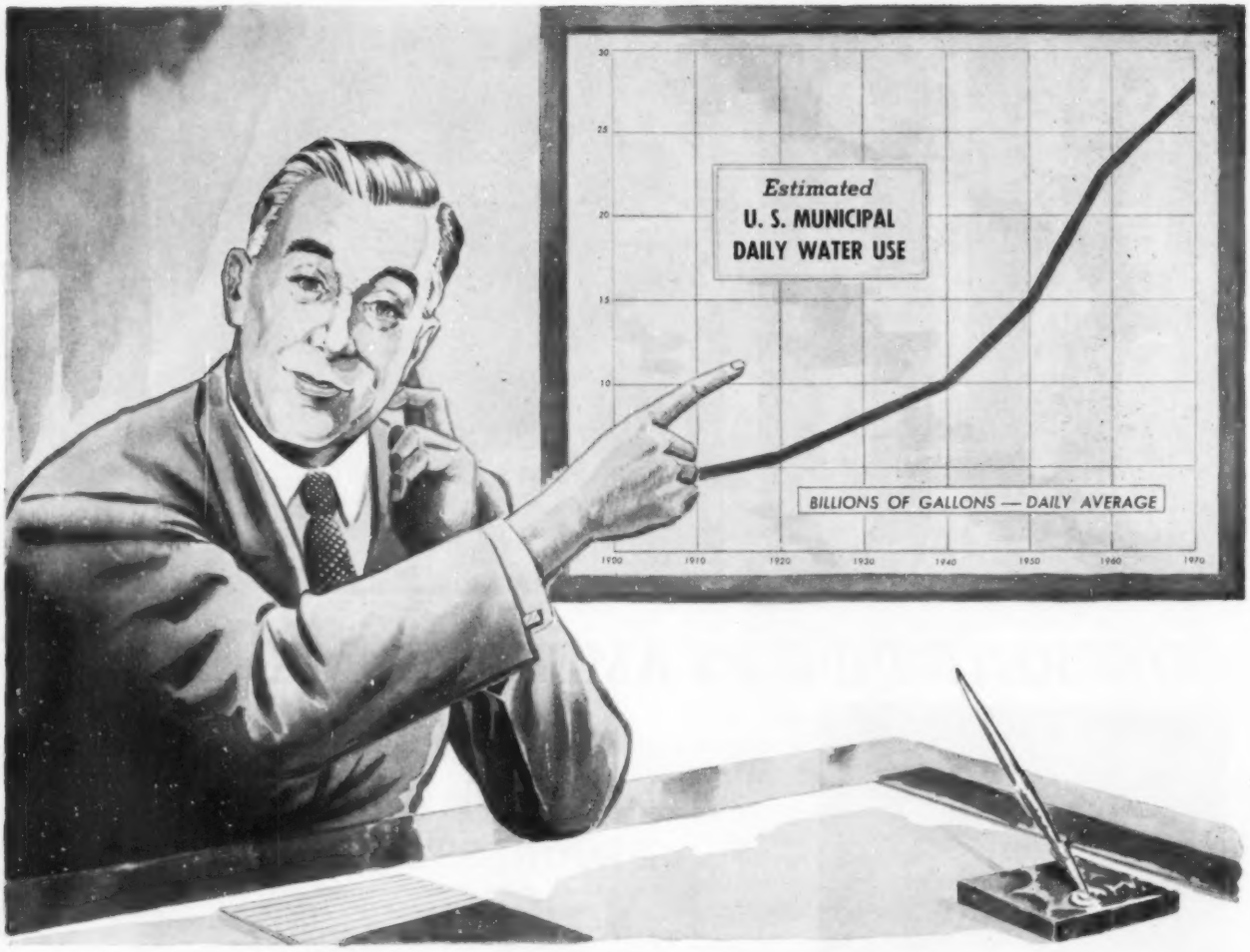

Time to plan for *your* city's future water needs

All around the U. S. A. communities are planning and making water main extensions in anticipation of their vastly increased future needs.

They are recognizing that population growth . . . increasing industrial water requirements . . . development of suburban and outlying areas . . . air conditioning . . . and greater use of water for many domestic purposes are stepping up demand by leaps and bounds.

An overwhelming majority of American communities are making water system extensions and improvements with

Permanent CAST IRON PIPE

"America's No. 1 Tax Saver"

because of its century and more of useful life, its minimum maintenance cost and superior shock-resistance and beam strength.

In your community, you too will find that Cast Iron Pipe will pay rewarding dividends for many long years to come.

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Since 1882

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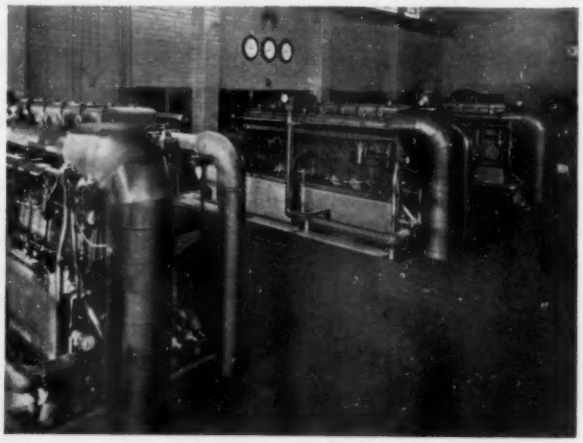
Our Company does not manufacture Cast Iron Pipe but supplies many of the nation's leading foundries with quality pig iron from which quality pipe is made.

"Behind-the-Scenes" LIFEGUARD to 12,000 acres of playland

An important role in cleaning up the waters of Jamaica Bay during the last four years has been played by the CP Dual-Fuel Engines that generate power for the Rockaway Sewage Treatment Works. The Chicago Pneumatic engines were installed by the Rockaway Pollution Control Project as an aid in the development of Jamaica Bay as a 12,000 acre swimming, boating and park area. These "behind-the-scenes" lifeguards are just one of the many units manufactured by Chicago Pneumatic that afford tops in power performance, low operating cost and rugged dependability. CP diesel, dual-fuel and gas engines are available in sizes capable of delivering from 120 hp. to 3000 hp. If your community is faced with purification problems of lake, river, bay or harbor, let Chicago Pneumatic do the same dependable job for you they are doing in this outstanding plant at Rockaway.

The New York City Rockaway Sewage Treatment Works.



Three 306 BHP, 600 RPM, Chicago Pneumatic Dual-Fuel Engines generating power for Rockaway Sewage Treatment Works.

Chicago Pneumatic *8 East 44th Street, New York 17, N. Y.*

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HUGE 5,000 CAR, 40-ACRE PARKING LOT BUILT OF *Soil-Cement*

This 40-acre soil-cement parking lot serves the Southdale Shopping Center near Minneapolis. The lot is one of the largest in America, offers off-the-street parking for 5,000 cars and serves 70 stores.

Even in severe climates like Minnesota's, soil-cement has a record of performance unequaled in the low-cost paving field.

Here is a dramatic example of the growing use of soil-cement for paving parking areas. For this purpose the soil-cement is usually built 5 or 6 inches thick and covered with a thin bituminous surface. Soil-cement provides a low-cost parking lot that's quick and easy to build and needs little maintenance. Further evidence of the trend to soil-cement is found in the fact that in the last two years soil-cement paving has been placed in parking and storage areas in 19 states.

Write for free literature on soil-cement paving for parking areas. Distributed only in the United States and in Canada.

PORTLAND CEMENT ASSOCIATION

Dept. A10-89, 33 W. Grand Ave., Chicago 10, Ill.

A national organization to improve and extend the uses of portland cement and concrete through scientific research and engineering field work

The problem of "lost" cars in large parking lots has been solved by a unique system of identifying each parking area with a colorful animal picture.

One of a series of reports to Traffic Engineers and Highway Officials on

BETTER SIGN MATERIALS

FACTS ABOUT PLYGLAZE® AND PLYALOY® OVERLAID PLYWOOD

- **WASHINGTON STATE SIGNS;** PlyGlaze Case History
- **COLORFAST BLACK PLYGLAZE;** No Paint Needed
- **DFPA VANDALISM TESTS;** Trial by Gunfire

PlyGlaze case history

Under its current signing program, Washington State has standardized on high density overlaid plywood for all fully reflectorized large information and directional signs. The state also uses the material for standard reflectorized warning and regulatory signs.

Work is carried on by the State Highway Department under the direction of Rex Still, State Traffic Engineer, and Al Solberg, Sign Engineer. Both have long been regarded as leaders in the highway sign field.

Under the new program, signs are made to state specifications by independent contractors, most of whom rely almost exclusively on St. Paul's PlyGlaze.

Washington has had experience with ordinary plywood as well as metal signs. The reasons they have switched to high density are primarily cost, durability and fool-proof bonding of reflective sheeting. The high density plywood signs cost less in the long run and even have an advantage in initial cost, because no prime coat is needed before applying reflective sheeting.

PlyGlaze stands up better under severe weathering and accidental or deliberate abuse. Because there is no progressive deterioration after gunshot or other damage, a slightly damaged sign can remain in service where signs of other materials would rust or corrode to the point where they would require replacement.

In commenting on sign materials, both Messrs. Still and Solberg are emphatic about one point: high and medium density overlaid plywood must not be confused. High density (PlyGlaze) requires no paint protection, permits direct bonding of reflective sheeting; medium density (PlyAloy) is for painted signs and must be primed before reflectorizing.

Their note of caution is strongly seconded by the St. Paul Technical Department. Both are excellent materials, but each is tailored for different signing conditions: high density, reflectorized, for 24-hour traffic; medium density, plain painted, for daylight conditions.

black background signs

Black PlyGlaze is now being used by several states for plain painted or reflectorized legend signs. The jet black overlay is attractive and can be used "as is" with legend applied directly to the panel. It requires no paint protection and because the color is permanently integral with the phenolic-resin overlay, it will not fade or bleach under even the most severe exposure.

trial by gunfire

Extensive vandal and abuse resistance tests conducted by Douglas Fir Plywood Association show that the sign base material has everything to do with whether or not a highway sharp-shooter can render a sign hors de combat.

The net of their findings is that overlaid plywood suffers substantially less from damage by gunfire than either steel or aluminum. Not only is initial damage less, but there is no progressive deterioration as with metal.

Tests were conducted under carefully controlled conditions using standard 24" square reflectorized signs of ⅝" overlaid plywood; 6061-T6 type .081" aluminum; 16 gauge bonderized steel. Signs were shot with .22 and .38 caliber and .300 Savage bullets.

Holes in the plywood were small, sharply defined. Slugs tore jagged holes in aluminum and created shock areas loosening reflective sheeting. The .22 and .38 bullets did not completely pierce steel signs, but created large shock areas which removed sheeting, exposing metal; .300 Savage slugs went through the steel.

If you'd like the complete 32-page test report, please mail coupon.

description, specifications

PLYGLAZE:* Exterior plywood with high-density phenolic resin-fiber overlay fused to both sides of panel. Overlay is hard, glossy, abrasion resistant, need not be painted. Ideal base for reflective sheeting. Colors: buff, black.

Specification: PlyGlaze (B-B) 60/60 High Density Overlaid fir plywood, manufactured by St. Paul & Tacoma Lumber Co.

PLYALOY:* Exterior plywood with smooth, durable medium-density overlay on one or both faces. Overlay is ideal paint base; has texture similar to expensive drawing paper. Color: buff.

Specification: PlyAloy Medium Density Overlaid fir plywood, faced both sides (F2S) . . . or faced one side (F1S) . . . manufactured by St. Paul & Tacoma Lumber Co.

*Both PlyGlaze and PlyAloy meet U.S. Commercial Standards, are DFPA-Inspected. Available in standard plywood sizes, thicknesses.

FOR MORE INFORMATION (detailed specifications, application data, etc.), **please mail coupon**

ST. PAUL & TACOMA LUMBER CO. TREE LIFE FOREST PRODUCTS ESTABLISHED 1888

St. Paul & Tacoma Lumber Co., Dept. PW, Tacoma 1, Wash.

Send literature and/or material checked:

- ☐ Specification & Application Data
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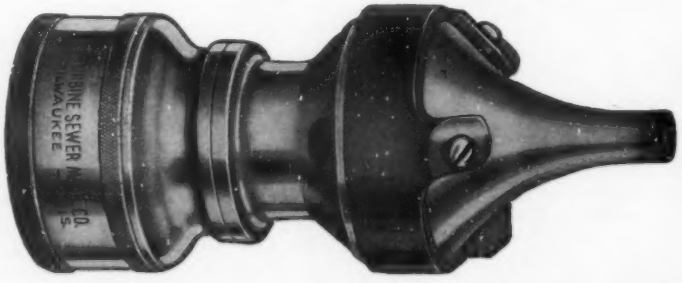

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SPECIFICATIONS AND COST DATA FOR CIVIL ENGINEERS

This book comprises contract documents, specifications, and cost data, together with discussions into such subjects as evaluation, glossary, depreciation and obsolescence, mechanical and electrical power costs. This revised Third Edition has been widened to include cost data coverage and to bring it up to date. The specifications have been extended and revised to cover such matters as recommendations for painting and wood preservation. To the Costs Section have been added the following: Economic studies of various types of enclosure walls for industrial buildings; costs of shopping centers; cost and capacity of off-street parking facilities; cost of cleaning and painting existing steel structures; highway culvert costs; comparison of treatment plant costs; economic study of flexible vs. concrete pavements; and analysis of building costs. The author is Elwyn E. Seelye and the publishers are John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. The price is $20 per copy.

HOOVER'S WATER SUPPLY AND TREATMENT

The first seven editions of this book were prepared by the late Charles P. Hoover, and this, the eighth edition, was prepared by Merrill L. Riehl, Supt. of Purification and Chief Chemist of the Mahoning Valley Sanitary District, Youngstown, Ohio. A chapter on fluoridation of water supplies has been added, and the chlorination section has been expanded to include new chlorination equipment. Latest methods for determining hardness, calcium and magnesium content, bacteria, and calcium carbonate stability are also included. In addition, revisions were made covering disposal and reclamation of water softening sludge, recarbonation, taste and odors, and silica removal with dolomitic lime. More than 100 illustrations are included, many of which are multicolor. Copies of the 8th edition may be obtained from the National Lime

No "Cure-All," but...

Salinas, California, finds a single grade of Bitumuls® solves five paving maintenance problems

HERE'S A SITUATION common to most growing cities: annexation of outlying residential developments has vastly expanded the street maintenance job *without* materially increasing available funds. Annexation has not only added to the street mileage, but has "contributed" many sub-standard pavements to the street system, thus adding to the complexity of the job.

In an effort to solve this problem, these three Salinas men most directly concerned have worked together: Thomas A. Dunne, Director of Public Service; his assistant, Al Rossi; and Harry Adams, Maintenance Supt. Their search for simplicity and standardization led them to look for a versatile asphalt material that would do many jobs. They found it in Bitumuls SS-1, an asphalt emulsion that can be handled and used without heating, in small quantities or large.

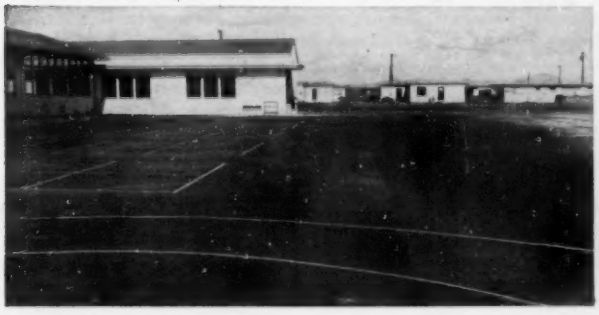
Now, stored in a single 25,000-gallon tank, Bitumuls SS-1 is used for: Patching, Tack Coats, Prime, Seal Coats & Surface Treatments, and for Base Stabilization. In addition, Salinas City Forces can also use this same grade of Bitumuls for the new Slurry Sealing; and—at high dilution—for dust-laying on unpaved, outlying roads. All of these jobs can be done with existing equipment: a grader, a "Pulvimixer", a water wagon, two distributors, and a roller.

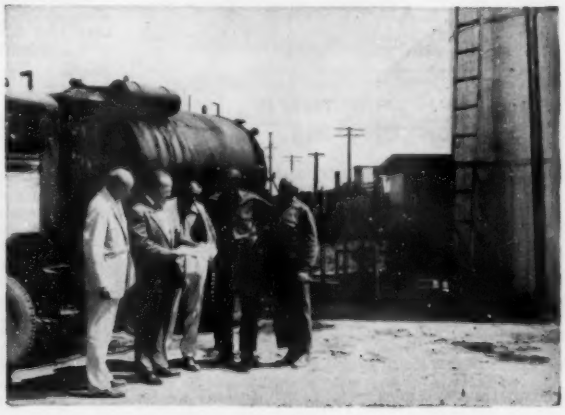
The obvious economies resulting from the use of this one material for all these jobs merit investigation by paving maintenance men everywhere, regardless of the size of their community.

There's a Bitumuls man near you who can supply details. *Call him, today, or write:* **American Bitumuls & Asphalt Co., 200 Bush St., San Francisco 20, Calif.**

(Top), "PULVIMIXER" reworks old pavement that has been scarified and bladed in restabilization operation. Distributor applies Bitumuls at ¾ gal./sq. yd. per inch of depth. (Center), DISTRIBUTOR applies prime on a waterbound base, using Bitumuls SS-1 diluted (2 parts SS-1 to 1 part water) at 0.3 gal./sq. yd. of dilution. (Bottom), HERE'S A CLOSE-UP of the finished texture of a Bitumuls SS-1 Seal Coat pavement.

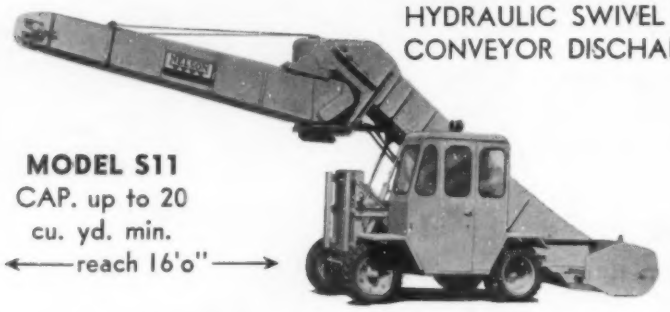
(Right), SALES ENGINEER Bob Ridell, far left, of American Bitumuls & Asphalt Co., discusses plans with Tom Dunne, Director of Public Service for Salinas, and his assistants. At far right is a partial view of the 25,000 gal. storage tank. (Below), EVEN SCHOOL YARDS are given stabilized bases with Bitumuls SS-1.





NELSON "OVER-CAB" SNOW LOADER

WITH ALL ALUMINUM HYDRAULIC SWIVEL CONVEYOR DISCHARGE



MODEL S11
CAP. up to 20 cu. yd. min.
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Permits single or double lane loading with trucks traveling either direction. The 16 ft. conveyor fully hydraulically operated, swings thru 90° circle for spot loading. For the most modern in snow removal methods get full facts on the Nelson S-11.

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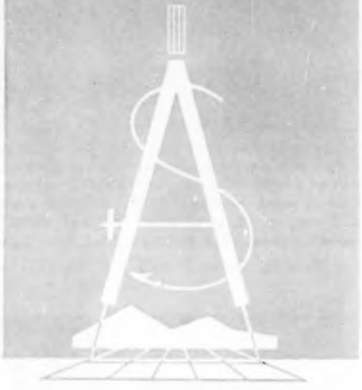

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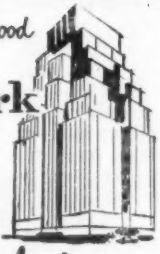

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EARTH PRESSURES AND RETAINING WALLS

This book bridges the gap between retaining wall design and that part of soil mechanics which deals with earth pressures and foundations. Using only principles and procedures with which the structural engineer is familiar, it covers all the common cases and most of the special conditions encountered in the design of retaining walls. The book emphasizes principles and offers numerical solution. It gives typical designs and tabulated computations, explaining the approximations and discussing the possible limitations. The author is Whitney Clark Huntington, Professor of Civil Engineering, Emeritus, University of Illinois. Publishers are John Wiley & Sons, Inc., New York City. Price per copy is $11.50.

BOUNDARY CONTROL AND LEGAL PRINCIPLES

This volume covers the legal principles of boundary control for abstractors, surveyors, title engineers, attorneys, and others who interpret, insure and locate deed descriptions. Sections covered are the meaning of deed terms and systems used to position and describe property lines; voluntary and involuntary methods of transferring property ownership; and the legal elements that determine the exact location of property, exclusive of possession considerations. Also included are pitfalls to avoid, procedures to use, and dangers encountered in composing deeds and making surveys. The author is Curtis M. Brown and the publishers are John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price per copy is $7.50.

THE DESIGN OF A HEAT PUMP BURIED COIL

This publication describes the procedure for utilizing a basic equation to obtain the appropriate length and configuration of the buried coil in a heat pump installation employing the earth as the heat source and sink. Definitions of the quantities of the equation and methods for their evaluation are presented. Authors are Donald M. Vestal Jr., and Billie J. Fluker. Bulletin 139 is available from Texas Engineering Experiment Station, The Texas A and M College System, College Station, Texas, and are $2 each.

BEAM DATA

Depth, 21"; Width, 36"; Span Length, 40'4"
Designed for H20-S 16-44 highway load
Manufactured by MISSOURI PRES-CRETE, INC.
Overland, Missouri

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Laclede quality welded wire fabric is shown being placed as the outer reinforcement in the forms, prior to the pouring of prestressed concrete girders at Missouri Pres-Crete, Inc. in Overland, Mo.

Girders, joists and columns manufactured here for highway bridge construction, roof and floor supports, permit faster erection in the field at lower cost—while offering greater architectural flexibility and lower subsequent maintenance cost for wide span, heavy load structures.

Laclede Reinforcing Steels for prestressed and precast concrete members:

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welded wire fabric
high strength wire
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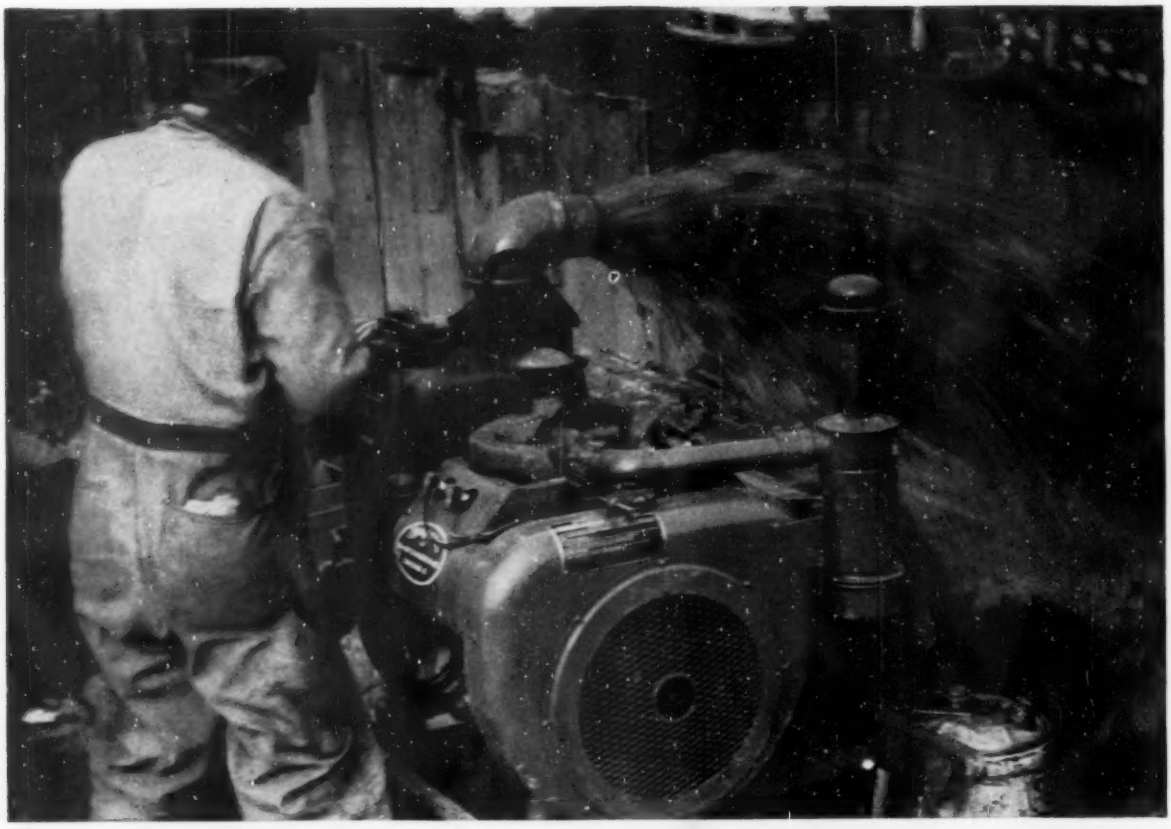


Gorman-Rupp Pumps keep this hot job moving!

The Horvitz Company, under a $2½ million contract, is building a ten-span bridge over the historic Ohio Canal and Cuyahoga River near Cleveland. The job, which includes two other bridges and river relocation, opens up a direct connection between heavily traveled Routes 8 and 21.

Constant seepage from the canal is always a threat for Mike Sekela, supervisor for Horvitz. Here he has spotted a Gorman-Rupp 40M Pump, Model 34A-VG4D, to dewater the cofferdam 20 ft. down for pilings. Mike says, "We prefer Gorman-Rupp because of their proven dependability."

THE GORMAN-RUPP COMPANY

305 Bowman Street • Mansfield, Ohio

NEW MEXICO proves OVERLAID FIR PLYWOOD SIGNS best by test

Plagued by vandals—who took an annual toll of over $25,000—and damage from severe weathering, the State of New Mexico Highway Department five years ago began a series of laboratory and field tests to develop signs which would effectively lower maintenance and replacement costs.

As a result, the department reports overlaid plywood the most durable of all sign materials. The state is now using it to replace steel and aluminum for signs in areas where vandalism had been prevalent. To date over 44,000 overlaid plywood signs have been placed in service. In all cases, they have lived up to expectations.

The Highway Department also cites superior paintability, ease of fabrication and elimination of framing or backing in larger signs as additional points in favor of overlaid plywood signs.

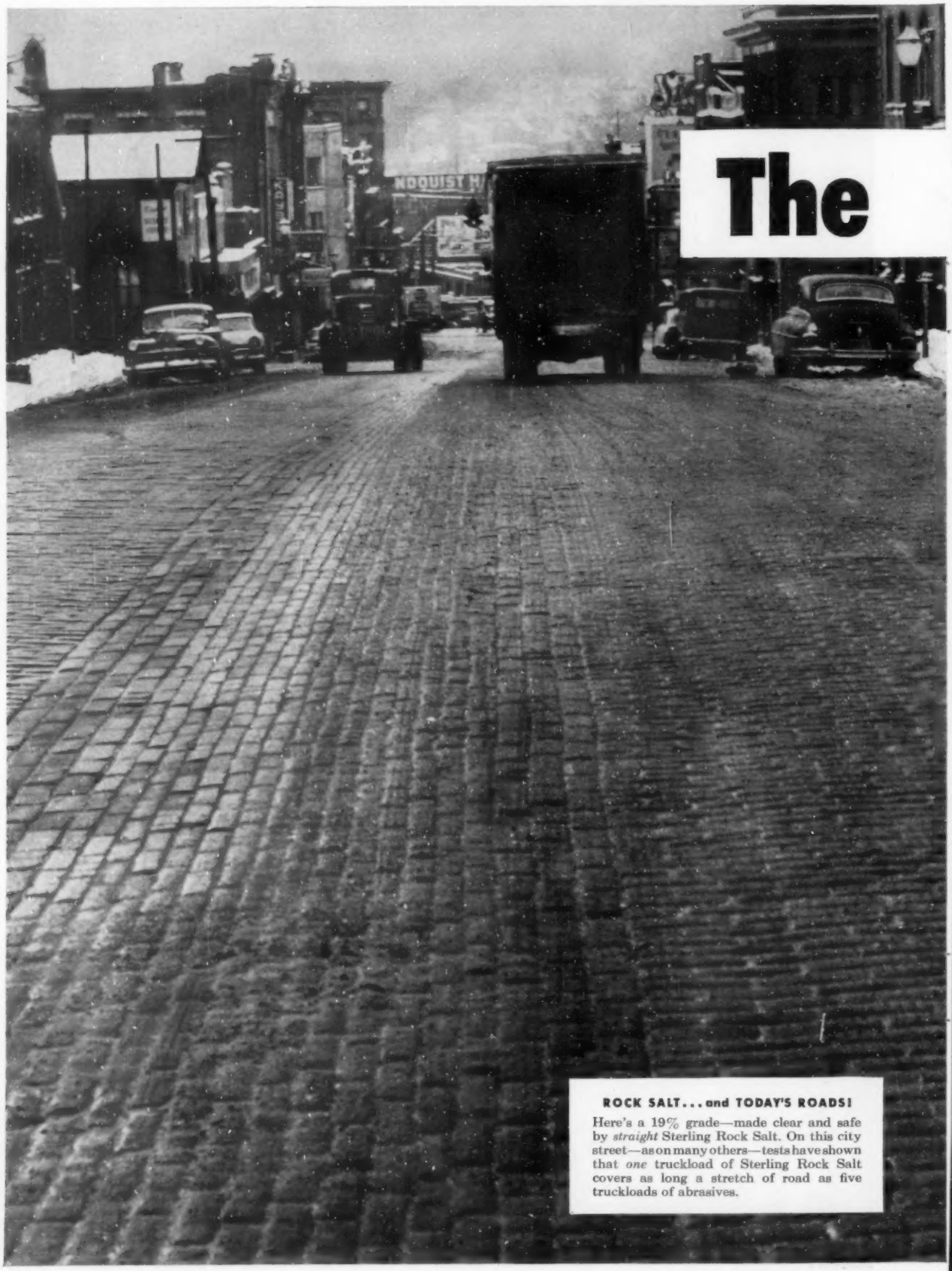
OVERLAID FIR PLYWOOD* GIVES YOU THESE ADVANTAGES

- Combines strength, rigidity and workability of plywood with smooth, durable, fused resin-fiber surfaces.
- Great resistance to severe weathering . . . accidents . . . gunshot, bending, other acts of vandalism. No progressive deterioration after damage. Cannot rust or corrode.
- Perfect for long-lasting paint or silk screen finishes. Reflective sheeting may be applied direct to high density overlay, eliminating prime coat.

*OVERLAID PLYWOOD is top-quality DFPA quality-tested Exterior fir plywood (EXT-DFPA®) with durable fused resin-fiber surfaces. Two types: (1) High density overlay is hard, glossy...need not be finished; (2) Medium density (paint grade) is smooth, opaque.

DOUGLAS FIR PLYWOOD ASSOCIATION
Tacoma 2, Washington, Dept. 140 (Good USA only)
Please send complete application-specification data on overlaid plywood for traffic signs.

Name_____
Firm or Dept._____
Address_____
City_____ Zone____ State_____



ROCK SALT... and TODAY'S ROADS!

Here's a 19% grade—made clear and safe by *straight* Sterling Rock Salt. On this city street—as on many others—tests have shown that *one* truckload of Sterling Rock Salt covers as long a stretch of road as five truckloads of abrasives.

only safe pavement is a bare pavement!

...and only straight rock salt can give you bare pavements during winter storms!

There's a growing trend today to the use of *straight* Sterling Rock Salt for ice and snow control. Reason: The increasing volume of traffic during winter months has created a critical need for bare, safe road surfaces during storms. And experience has shown that abrasives—even when mixed with salt—*just don't do the job!*

Actually, sand and cinders are inert. They don't melt hard-packed snow . . . have no effect on ice, sleet and freezing rain. And they do not provide traction for any length of time. Wind and traffic quickly scatter abrasives to the side of the road!

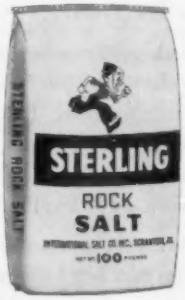
Here's a typical report on abrasives: "During a heavy, continuing snowstorm, sand and cinders don't help us at all. No matter how thickly spread, these abrasives are soon covered by as little as ¼" more snow. Frequent, costly reruns are often needed. What's more, abrasive layers seem to retard the natural melting process."

The answer is straight Sterling "Auger Action" Rock Salt. Problems simply don't occur when streets are cleared with this effective melting agent! Sterling Rock Salt helps turn snow into slush—quickly. And when ice forms, the salt crystals (with exclusive "Auger Action") *bore* through the ice layer to the road surface. Here, brine is formed . . . and spreads out to break the bond between ice and pavement!

Sterling Rock Salt has superior melting power at low temperatures, too. All that's necessary is to increase the amount of salt used as the temperature falls. This melting agent leaves no expensive clean-up jobs. It combines with the snow and ice it melts, and runs off the road leaving a bare pavement—the *only safe pavement during winter storms!*

Now's the time to complete your stockpiling of Sterling Rock Salt. Remember, winter demands can make deliveries uncertain!

You can protect rock salt from caking in storage with new Sterling Storite. This remarkable chemical keeps salt free-flowing, ready for immediate use. Send for free booklet giving full details.



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STERLING "Auger Action" ROCK SALT

International Salt Co., Inc. • Scranton 2, Penna.

ONE CAT D4 TRACTOR HANDLES ALL HARTFORD'S PARK JOBS

Routine jobs and odd jobs—the Park Department of Hartford, Conn., has plenty of them. But one machine takes care of them all. It's a versatile and powerful Caterpillar D4 Tractor.

The work going on in the picture above falls pretty much into the "odd job" category. An attractive new public swimming pool, 150′ x 150′, was recently constructed in the city's Keney Park. The contractor left the surrounding area rough graded, and the D4 is busily at work on it, leveling in preparation for seeding.

There's testimony to the D4's power (63 HP at the flywheel) in that big load in front of the No. 4S Bulldozer. And its maneuverability lets this husky tractor work in close to the trees.

Here's what Park Commissioner Alfred J. Therkelsen has to say: "We've always liked Caterpillar-built Tractors. They're easy to maintain and require very little repair work. They're very economical, too, and have a long work life." Mr. Therkelsen is in a good position to judge, because the Park Department's CAT* D4 Tractor is on the job 8 hours a day, 5 days a week.

Your Caterpillar Dealer has the complete story on this efficient, economical multi-purpose tractor. He can tell you what it can do for your community—and demonstrate right on your job. And he'll back his product with prompt service and parts you can trust.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

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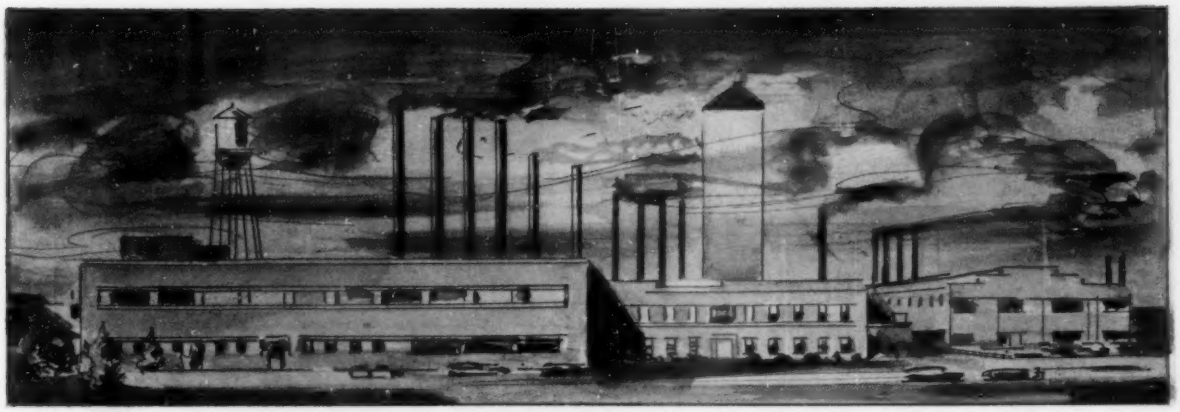
SAVING TAXPAYERS' DOLLARS

PUBLIC WORKS
MAGAZINE
Vol. 88, No. 10 Oct. 1957



AIR POLLUTION and the Courts

JAMES A. TOBEY

Dr. P.H., LL.D.,

Member of the New York Bar

AMONG THE MANY legal rights of the United States citizen is the right to the enjoyment and use of an atmosphere which is reasonably free of artificial impurities. Like many other legal privileges, this right is not absolute but is conditioned to a certain extent by the character of the community in which the citizen resides. If he elects to live in a heavily industrialized area, he must expect and must endure some discomfort from smoke and fumes.

When, however, pollution of the natural atmosphere by smoke, fly ash, carbon, cinders, soot, grime, dust, fumes, gases, noxious acids, and particulate matter, or any combination thereof, becomes so great as to endanger health, injure property, and/or cause unusual discomfort and inconvenience, a nuisance is created. It may be a private nuisance, a public nuisance, or both. For such a legal wrong there is always a remedy at law, either by an action for damages by the injured individual, or by an action by the state to abate, enjoin, control, or penalize the nuisance in the interests of the general welfare. Such individual and official legal actions may, of course, be concurrent.

As early as 1883 the Supreme Court of the United States upheld an award for damages to a householder for a nuisance due to gross discharge of smoke from a railroad tunnel adjacent to a residential area[1], and again in 1891 sustained a second award for damages for the same condition by the same railway company[2]. In this latter decision the court cited with approval the principle laid down by Blackstone in the 18th century that a nuisance continued is a fresh and actionable nuisance every day of its existence.

At common law, smoke was not *per se* a nuisance, but circumstances could make it so, and modern legislation also can modify the common law in this respect. From 1864, when excessive smoke was declared to be a nuisance in a court action in St. Louis, to the present time there have been literally hundreds of decisions by courts of last resort in this country holding that extraordinary and unreasonable pollution of the atmosphere is an actionable nuisance for which legal relief must be granted[3].

The right of the state itself to restrain the pollution of the air over its own territory came before the Supreme Court of the United States in 1907 in a lawsuit brought by the State of Georgia against an industrial concern in Tennessee. In granting an injunction to prevent such pollution, Mr. Justice Holmes stated for the court that, "It is a fair and reasonable demand on the part of the state that the air over its territory should not be polluted on a great scale by sulphurous acid

(*Continued on page* 184)

A Well-Planned
SNOW and ICE PROGRAM

LEONARD H. CARO,

Director of Streets and Sewers,

Peoria, Illinois

OUR PRIMARY snow and ice control program is based on natural conditions expected in Peoria during the winter period. A 25-year experience indicates an average snowfall of 22 inches each year. A 10-year review of storms shows that we can expect an average of 22 snow falls and 6 days of freezing rain each year. With an average storm precipitation of well under 1 inch it becomes most practical to equip and prepare ourselves for snow removal by melting with salt.

Abrasives, such as cinders which are plentifully available to us, are useful when temperatures are very low and in emergency application to give immediate traction on hills and bridges. The use of cinders, however, is expensive and only the immediate need for traction is served. Since cinders do not remove snow or ice, cindered streets must receive further attention with salt or removal equipment in order to do the job. Then when the snow is removed or melted the cinders must be swept off the streets or cleaned out of sewers. Therefore, cinders should be used only when necessary.

The only satisfactory solution to the motorist's wintertime problem is a bare pavement. This can be obtained by plowing followed by salt application. Where the average snowfall is less than 1 inch, plowing is usually impractical. Therefore, in Peoria we rely on salt to clear our streets, using plows when necessary.

The City of Peoria has turned to greater use of salt for snow and ice control. This will continue to be true. It is necessary, however, to make the best use of salt to obtain the best results. We use enough salt to do the job. We place the salt properly. We use the salt in accordance with temperature conditions affecting melting action.

Photos courtesy Peoria Journal Star

● **BEFORE winter weather arrives, sand boxes are placed at critical points for emergency use by the public while spreading and plowing crews clear the streets.**

Using less salt than is required is not a saving—it is a waste. Too little salt takes about the same effort to apply, costs little less for material used, and does not clear the street of ice and snow. When sufficient salt is applied in the first place, snow and ice can be removed Then repeated efforts of Street Department crews are not wasted going over the same streets after initial control of the storm has been obtained. We use 1000 pounds mixture per mile of two lane roadway for each 2 inches of snowfall.

The salt must be placed on the centerline crown of the pavement so that the natural drainage of the street will remove the snow and ice from the center to the gutter as melting action proceeds. If the center of the street were left with ice and snow while traffic lanes were cleared we would create a problem. Daytime melting and night freezing would require repeated efforts to treat drainage on traffic lanes.

Rock salt does a good job of melting when temperatures are above 20 degrees. It has a lasting effect in melting and provides a tacky surface for traction in driving. Its melting action is too slow to be of immediate benefit below 15 to 20 degrees. Calcium chloride is quick-acting in melting snow and ice at the lower temperatures down to zero. It does not last as long as rock salt but does last long enough to get an immediate melting action started so that the slower-acting rock salt can continue that melting action for a longer time. We take advantage of the best action of rock salt and calcium chloride by using a 2 to 1 salt to chloride mixture. This makes it possible to use salt when we might otherwise be required to use cinders at the lower temperatures.

Equipment and Facilities

Only 2 percent of winter storms produce snowfalls over 4 inches in

depth in Peoria. Therefore, only a minimum of equipment is available for use under heaviest snow conditions. Working arrangements are made with local industry and contractors to provide snow removal and hauling equipment when deep snow conditions require emergency action.

Storm control operations are directed from the Street Department where basic equipment and supplies needed for immediate action are located. Rock salt, calcium chloride and cinders are stocked in the buildings or yard in sufficient quantity to handle storms of experienced intensity and duration. All equipment is either on hand or called back at the time of the storm to be made available for immediate use in fighting storm conditions.

Ten dump trucks of one-ton and two-ton capacity and six pick-up trucks of one-ton capacity are available for use. The pick-up trucks are used for spot work, such as hand application of salt or cinders at intersection stops, small dead end hills and other locations where the use of more productive equipment might be wasteful. The dump trucks mount equipment for the major work. Two reversible, trip-blade, front-mounted plows, four tailgate cinder spreaders, and five tailgate-mounted salt spreaders are used to plow and spread materials on streets as necessary.

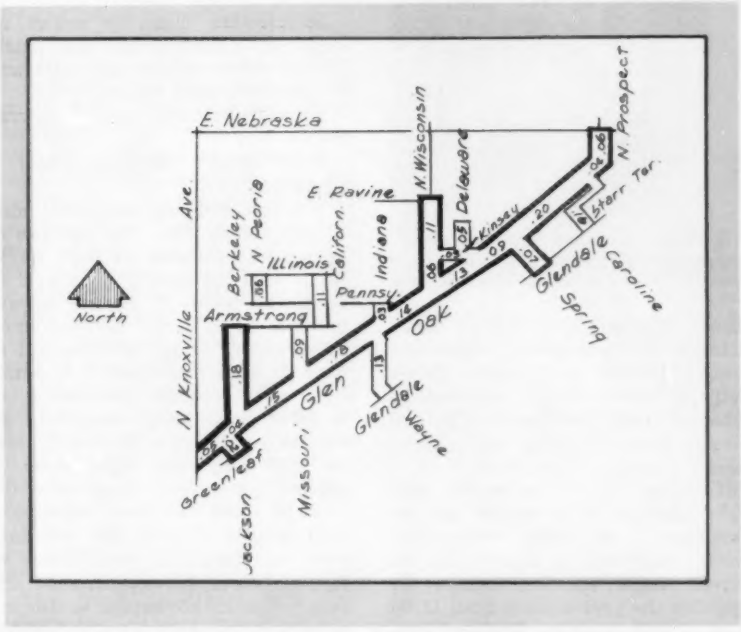
Loading salt from the Street Department storage room, across the dock and into trucks is accomplished by hand labor using gravity type roller conveyors. Salt bags are opened and dumped into the tailgate-mounted salt spreaders to distribute the salt as trucks drive over streets to be treated.

A rubber tired end loader is used to load cindering trucks from a storm stock pile in the Street Department yard. Use of the one yard bucket permits accurate measurement of cinders loaded. In operation the tailgate cinder spreaders are fed by lifting the dump box. The screw-type spreader then deposits a one lane spread alongside the centerline of the street.

Only sufficient cinders to handle two or three storms are stocked at the Street Department yard. Lack of space prohibits a large stock pile there, but close control of dispatch procedures and equipment use requires storm loading at that point. The major stock pile of cinders, collected throughout the year for street and alley fill as well as winter storm use, is located several blocks from the yard in an out-of-the-way location. Cinders for winter storm application are stocked in the open with no cover at both sites. Approximately 75 pounds of calcium chloride are added to each cubic yard of cinders to prevent freezing and to provide better retention when spread on ice and snow.

falls require clearing of major hills, bridges and business streets or to plow center-line accumulations over to the gutter for melting. The road grader is pressed into service last. It is used for emergency snow and ice removal.

The use of these pieces of equipment is dictated by the type of storm, be it light or heavy snow,



● **MAP is part of dispatch sheet for each spreader route. By varying truck speed, heavy outline streets get 2000 lbs. of salt per mile; lighter outline streets 1000 lbs. In addition to street plan, each form shows time out and in, material spread, etc., to allow dispatcher to check storm control progress as drivers finish the run.**

Considered auxiliary equipment, a track-type end loader, a farm tractor, a road grader, and the two front-mounted truck plows are available for use when needed. In a cindering operation, the track-type end loader can be used to work at the major stock pile to load trucks directly for spreading or for replenishing the storm stock pile at the Street Department yard. If it becomes necessary to put the rubber-tired end loader on the streets to load snow, the tracked equipment is used to load from the yard. The farm tractor can be equipped with a plow to clear slush and snow from intersection curb returns, uncovering drainage structures and opening crosswalks to pedestrian traffic. A limited use of the farm tractor can be made for sidewalk clearing, but that job is generally performed by the adjacent property occupants. The front-mounted truck plows are used when heavy snow-sleet or freezing rain. Limitations in available manpower make it necessary to choose which will be used under the conditions existing rather than to use all of it.

Manpower For Storms

When a winter storm arrives all other Street Department activities cease in favor of the immediate job. That job is keeping traffic moving as safely and rapidly as possible within the means available to do so. Only operations of equal emergency character are permitted to continue. Other city departments are pressed with their own problems associated with the storm so that personnel outside of the Street Department are available to fight street conditions only in the extreme emergency or in related activities which are a part of their own departmental operations.

The maximum number of Street Department personnel available to

● SALT spreaders are the workhorses of the snow and ice program.

man equipment and provide labor consists of twenty-four operators, truck drivers and truck driver helpers, twelve street maintenance laborers, designated Laborer II, and eleven street cleaning and general laborers, designated Laborer I. Thus forty-seven men are available with light absence of personnel and no assignment to other emergency work. However, a night crew of driver, helper, and four Laborer I's operates the year around from 11:00 p.m to 7:00 a.m. for business district cleaning. This crew is used for holding or clean-up operations before the major crew arrives to fight the storm or after the major effort has been made. These men cannot be considered for the general storm plan. Assuming heavier absence for sickness in winter we can usually count on forty men. Generally the timing and duration of the snowfall is such that a split crew is desired to give continuous treatment to streets until a safe pavement condition is achieved. Splitting the crew for round-the-clock operation cuts the available number of men to twenty, or approximately ten operators, drivers, and helpers, six Laborer II's and four Laborer I's.

Personnel available must be balanced against equipment operation requirements. Desired personnel for manning various equipment are as follows:

Five salt spreader trucks: 5 truck drivers, 5 truck driver helpers and 5 Laborer I.

Loading salt trucks: 2 to 4 Laborer II.

Spot spreading with pick-up truck crews: 2 to 4 Laborer II.

Hauling salt from warehouse: 2 dump trucks, 2 truck drivers and 4 Laborer II.

End loader for loading cinders: 1 operator.

4 Cinder spreading trucks: 4 truck drivers and 4 truck driver helpers.

2 Front-mounted truck plows: 2 truck drivers and 2 truck driver helpers.

Intersection clean-up crews as required: 1 truck driver each truck, 1 truck driver helper each truck and 1 Laborer I each truck.

Farm tractor with plow: 1 operator.

Road grader used as plow: 1 operator.

It is apparent that equipment must be selected to make the best use of personnel available as well as to fight most effectively the type of storm at hand. It is not always possible to split the crew; it may be necessary to put all men out at once. In many instances it is possible, with accurate forecasting of weather conditions, completely to service the streets with the full crew so that only the night crew is needed for a time. They care for trouble spots or give emergency holding action until the off duty crew can be called out in case of further storm development. In any event, it is an advantage to use the snow and ice control method which gets the job done so that frequent servicing of the same streets is reduced to a minimum.

Working With Others

Without the assistance and cooperation of other agencies the task of fighting winter storms would be much greater and a planned attack more difficult. Among the activities for which the Street Department depends upon other agencies are weather forecasting; observation of air and ground conditions; traffic signal light changes; vehicular traffic control; exchange of information by radio; and division of the street servicing effort.

The city contracts for a commercial weather warning service which begins with the first winter storm producing hazardous driving conditions and ends with the last such winter storm. Over a period of several years this service proved better than 85 percent accurate in forecasting time and duration of storm, type of weather conditions to be encountered, and changes foreseen. The forecasting service provides initial warning, amplifying reports when required, and an answering service should the city find it necessary to question weather conditions.

The United States Weatner Bureau maintains a station outside of Peoria. The personnel at the weather station not only cooperate in advising as to storm progress upon call but have several times called to notify the city of unforeseen or unusual changes in the local weather condition.

Alert to the impending storm, the Street Department notifies other agencies. Caterpillar Tractor Company and the City of East Peoria, linked to the City of Peoria by three bridges spanning the Illinois River. are notified of hazardous weather conditions. Someone in 50 percent of Peoria families is employed by Caterpillar in East Peoria and so it is vital that traffic arteries between the two cities remain in safe driving condition. The other side of the river is handled by East Peoria and Caterpillar, the near side by our Street Department crews.

The bus company is informed of impending storm conditions so that company crews can apply cinders to hills and bus stops to keep bus transportation moving. Radio dispatched service cars are used to check progress and trouble spots in the bus company's operation.

Police and fire departments and city electricians are other city agencies notified of storm conditions. Electricians must be alerted to service possible signal light breakdowns in case of trouble. Police and fire departments are, of course, vitally concerned with the effect of storm conditions on their operations.

The police department, in addition to alerting police patrol units of storm conditions, sets in motion certain aids to help fight the storm. Signal lights at cross streets on two major hills are changed to flashing yellow by a patrol car to avoid a pile up of cars on the hill under icing conditions. Traffic jams are cleared and occasionally it is necessary to clear the way through traffic for Street Department vehicles servicing the streets. Air and ground conditions observed by patrol cars are reported to the Street Department for information. Trouble areas are reported by patrols so that crews can be dispatched to salt or cinder on an emergency basis.

The communications center, operated jointly by the police and fire departments, provides relay service between radio equipped Street De-

partment vehicles and the Street Department office so that more effective coordination may be achieved between field observers and Street Department dispatchers in effecting the salting, cindering and plowing operations.

Each fall a meeting is held to bring together representatives of the State Highway Department, the bus company, Caterpillar Tractor Company and the Cities of Peoria and East Peoria. New developments in control programs are reviewed, street servicing responsibilities determined and working agreements made for the ensuing winter. The City of Peoria also has maintenance agreements with Peoria County and the Park Board to determine which agency will care for certain borderline or boundary streets. Before winter comes, each agency is informed of its responsibilities and informal meetings keep that information up to date.

The Primary Plan

Weather, equipment and available manpower affect the method of storm control used. So does topography and street mileage. Peoria rises up from the Illinois River on land shaped like half a bowl, the open side toward the river, the upper edge of the bowl leveling off on a bluff approximately 700 feet above the river. Traffic to and from the business and industrial areas in the river valley, and traffic passing over the river to, from and through Peoria must follow arterial streets on long or steep grades. Of approximately 183 miles of paved streets, 123 are residential and 60 are considered arterial streets.

The cost of servicing all 183 miles of paved street is prohibitive. Even the cost of taking care of 60 miles of arterial streets appears to be higher than can be afforded with present methods and the time of spreading so lengthy as to preclude timely snow and ice removal or treatment. On some arterials the volume of traffic alone prevents a build-up of snow on the pavements. In Peoria the average light snows and lack of drifting make it possible to use a primary program of treating selected street mileage by salting, cindering, plowing, or a combination of these to keep traffic moving. The auxiliary program consists of treating intersections with salt or cinders and caring for other trouble spots as they develop.

Because of limited personnel and equipment, and because it works efficiently under our conditions, we emphasize the use of rock salt and calcium chloride, cindering only when the salts will not serve.

Thirty-six miles of two-lane salt application are made on a primary spreading network of streets. Included in the primary plan are bridges, hospital approach routes, arterial street hills, streets in the major business district and street sections known to develop particularly hazardous winter driving conditions, in that priority order. The street sections to be treated are divided into 9 spreading routes.

Rock salt and calcium chloride in a 2 to 1 mixture are spread unless it is known that temperatures will stay above or are rising well above 20 degrees. Then rock salt can be used. The mixture is applied at a rate of 1000 pounds per mile for each two lanes for every two inches of snowfall or less. For a greater depth of fall than two inches a repeat application is required. For streets with four traffic lanes application is doubled.

Each spreader truck is loaded with 51 sacks, 34 of rock salt and 17 of calcium chloride. This loading gives some leeway for wastage on routes designed to use a maximum of 44 one hundred-pound sacks under good operating conditions. Spreading is accomplished by operating the spreader at constant speed and varying the truck speed to determine rate of application.

The truck is driven with left wheels just right of the street centerline. The center-mounted tailgate spreader is operated with left deflector plate open and right deflector closed, causing the salt to spread over the centerline crown of the street.

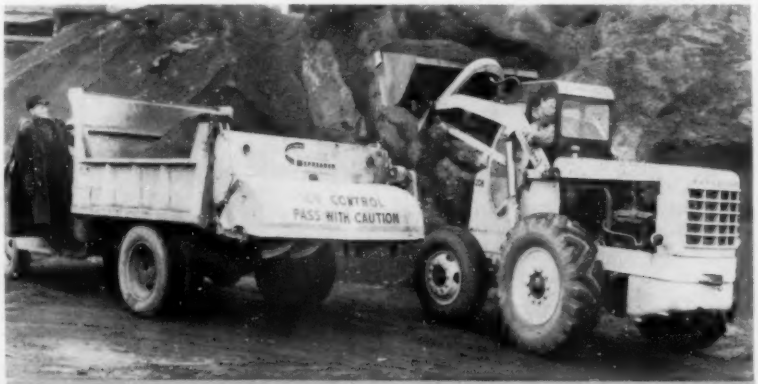
Spreader trucks are dispatched with a spreading route sheet. Street routes indicated on a Snow and Ice Control Map for the whole city are shown individually on the route sheets. Route sheets also provide for noting the time of start and return, equipment and crew used, quantity of material, and a check-off of street sections completed on the route. Using route sheets in priority order, the dispatcher can more easily assign and control the work. Using route sheets returned by truck drivers, the dispatcher keeps track of storm control by shading in the streets treated on a copy of the Snow and Ice Control Map. Thus he records overall storm control progress.

Improvements

Winter storm control is still in the process of evolution in Peoria. The last several years have produced a change from hand shoveling cinders, to mechanical spreading of cinders, to a primary emphasis on removal by melting with salt. In four years of use the commercial weather warning service has proved extremely useful. A limited use of radio indicates a more extensive use is desirable to keep the Street Department dispatcher in closer touch with spreading vehicles.

Economies in the use of bulk salt can be achieved with improved storage and loading facilities to provide lower materials cost, reduced handling, and quicker loading. Automatic-feed spreaders to use the bulk materials will permit a more efficient use of personnel in covering a greater street mileage in the primary street network and provide more flexibility in the spot coverage and special treatment auxiliary services.

All of the improvements mentioned above are planned, if not presently scheduled, constantly to improve safe driving conditions through the critical winter months.



● **STOCKPILED** cinders being loaded into a truck equipped with a spreader by a front-end loader. Cinders are stored in the open, at two sites, uncovered.

NOMOGRAPHIC SOLUTIONS

for the DESIGN of

Anaerobic Digestion Equipment

WALTER R. LYNN*

Director of Research

Ralph B. Carter Company

DESIGNERS OF sewage treatment installations frequently can save considerable time in initial design estimates through the simplified nomographic solutions in place of repeated mathematical formulas. In the August, 1957, issue of PUBLIC WORKS, nomographic solutions were presented for the design of trickling filters and sedimentation tanks. This article provides nomographs for the rapid solution of two factors in the design of anaerobic digestion equipment: Effective Digester Volume and Heat Requirements for Raw Sludge Additions.

Effective Volume

In the design of separate sludge digestion tanks most administrating agencies have developed standards which relate to the *effective digester volume*, required for the digestion of sludge. This effective digester volume has been defined as "that volume which should be calculated on the basis of the bottom having planes sloping 30 degrees from the horizontal upward from the end of the sludge withdrawal pipe . . . unless sludge moving equipment is installed"; (Upper Mississippi River Board — May 1952). Of necessity, computation of effective digester volume requires that some initial assumptions be made for solution of the tank dimensions. A formula can be developed which would present the diameter and depth of a cylindrical digester; however, this would also require a trial-and-error solution to arrive at the required effective volume. The nomograph shown on the opposite page similarly offers a solution to the problem of computation of effective digester volume; however, the graphical solution allows for a rapid computation of gross dimensions. The advantage to this graph is that it allows one visibly and quickly to note the effect of variables in terms of determining the dimensions for the required volume.

Sample Solution

The following example is illustrated by the red lines on the nomograph. This can be repeated quite simply for any required volume.

Required—Tank dimensions for an effective digester volume of 11,900 cubic feet.

Step 1. Assume tank diameter equals 35 feet and depth equals 20 feet.

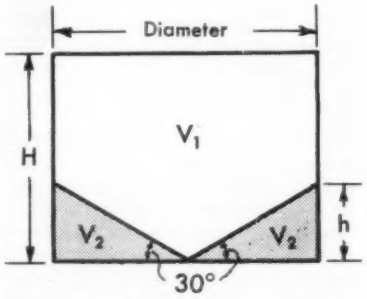
Step 2. Connect scales Diameter of Tank (A) with Overall Depth (B). Read from scale (C) V_1 = 18,000 cubic feet.

Step 3. Connect scales Diameter of Tank (A) with the Transfer Point. Read from scale (D) V_2 = 6,100 cubic feet.

Step 4. Effective volume = $V_1 - V_2$ = 18,000 — 6,100 = 11,900 cubic feet.

Step 5. To determine height of 30° cone, read value "h" opposite Tank Diameter on scale (E). h = 9.6 feet.

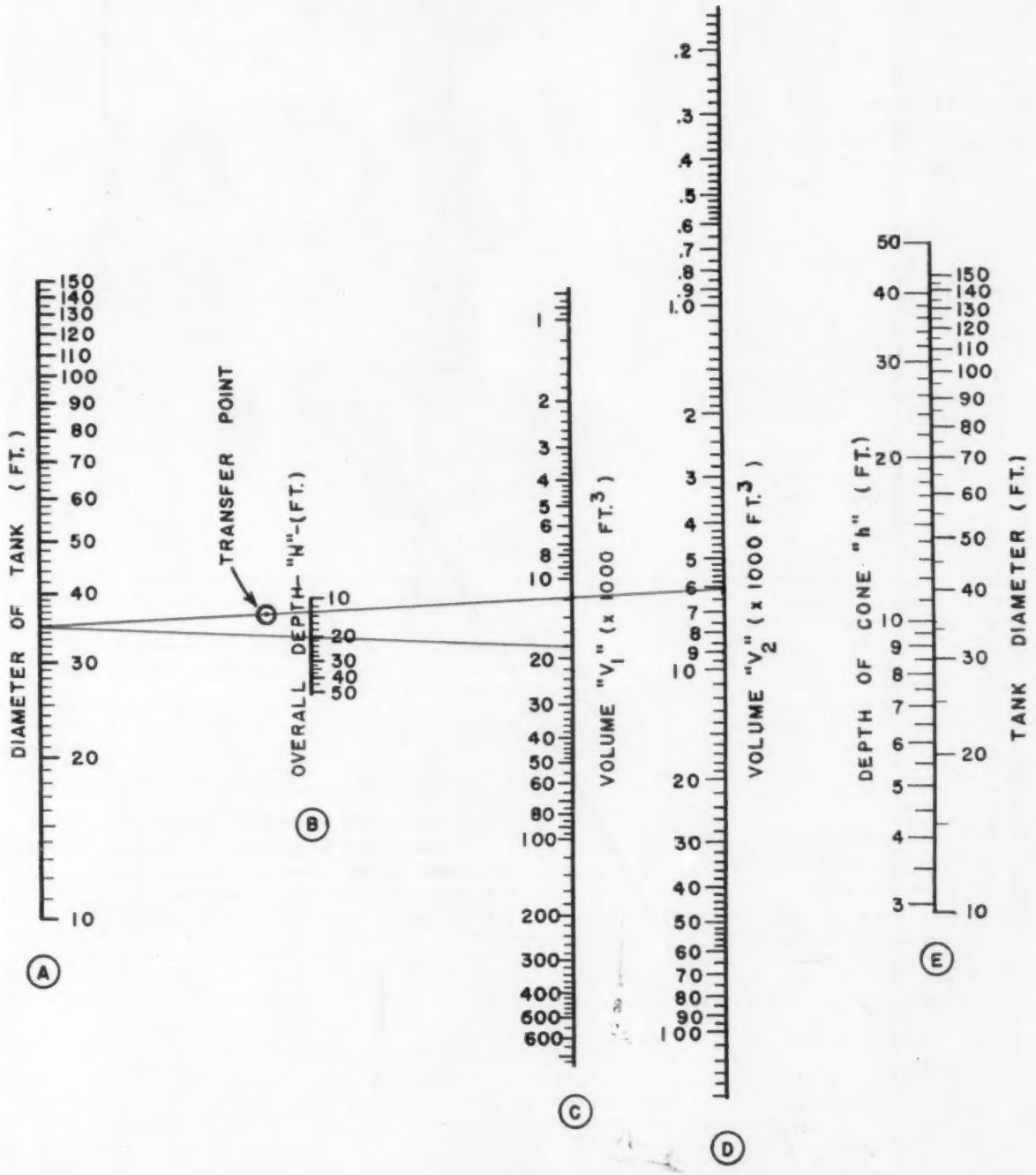
Note: If the effective volume determined in Step 4 is not that required for the installation being designed, the depth or diameter assumed in Step 1 can be revised quickly to arrive at the correct solution.



● **EFFECTIVE digester volume, according to U.M.R.B., equals $V_1 - V_2$ for a digestion tank where sludge moving equipment has not been installed.**

● **35-FT. DIAMETER floating cover installed at the Lyons, N. J., VA Hospital.**

* Mr. Lynn, formerly Director of Research of the Ralph B. Carter Company, is now Assistant Professor of Civil Engineering at the University of Miami.



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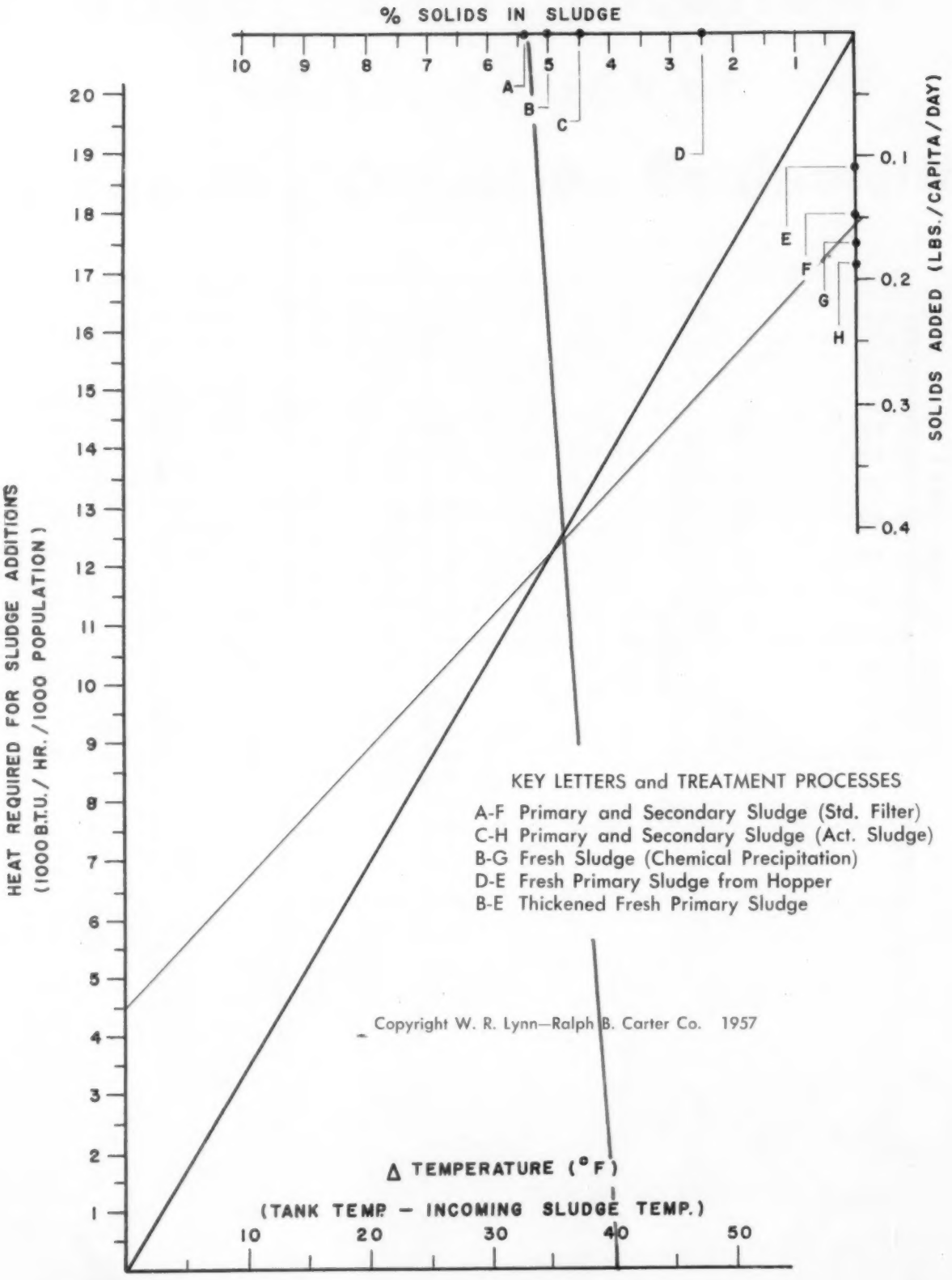
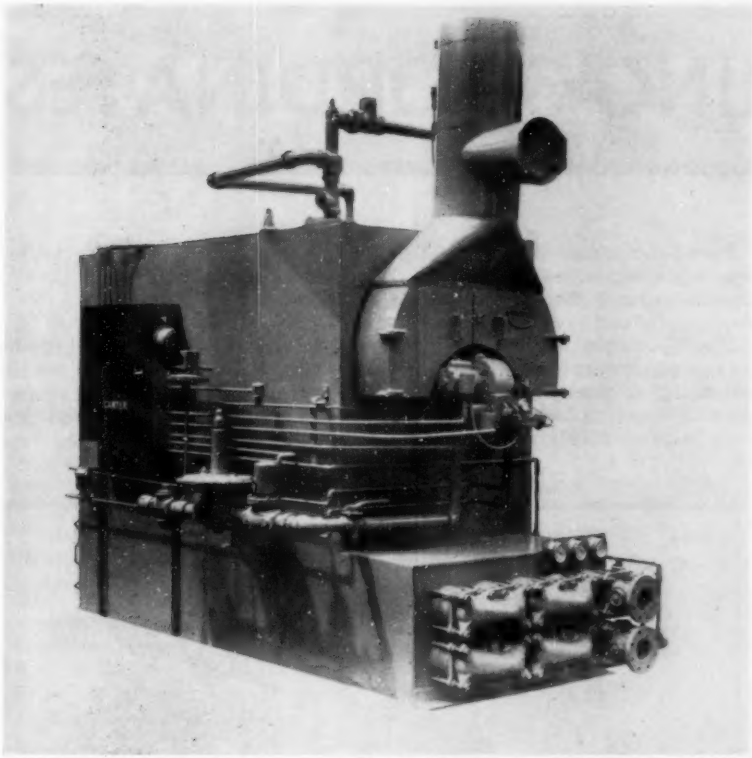
● **NOMOGRAPHIC** solution for effective digester volume. Red lines show solution of sample problem on opposite page.


% SOLIDS IN SLUDGE
10 9 8 7 6 5 4 3 2 1
A
B
C
D
E
F
G
H
HEAT REQUIRED FOR SLUDGE ADDITIONS
(1000 B.T.U./ HR./1000 POPULATION)
20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
SOLIDS ADDED (LBS./CAPITA/DAY)
0.1
0.2
0.3
0.4
KEY LETTERS and TREATMENT PROCESSES
A-F Primary and Secondary Sludge (Std. Filter)
C-H Primary and Secondary Sludge (Act. Sludge)
B-G Fresh Sludge (Chemical Precipitation)
D-E Fresh Primary Sludge from Hopper
B-E Thickened Fresh Primary Sludge
Copyright W. R. Lynn—Ralph B. Carter Co. 1957
Δ TEMPERATURE (°F)
(TANK TEMP. — INCOMING SLUDGE TEMP.)
10 20 30 40 50

● **HEAT REQUIREMENTS** for raw sludge additions at plants using various treatment processes are shown by this nomograph.



● 1,000,000 Btu heat exchanger ready for shipment by the Ralph B. Carter Co. This unit will be installed in the Hoboken, New Jersey, sewage treatment plant.

Heat Requirements for Raw Sludge Additions

Computation of the heat requirements for a sludge digestion tank necessitate that the heat supplied be sufficient for the following: 1) to raise the temperature of the raw sludge to that of the desired tank temperature; 2) to compensate for the losses of heat through the tank to the atmosphere and the surrounding soil; and 3) to compensate for whatever heat losses might occur in the transfer of the sludge from the heat source to the sludge digestion tank. The nomograph of digester heat requirements is intended to allow a rapid computation for the heat needed for the raw sludge additions as stipulated in 1) above. In order to use this graph three variables must be known, the percent solids in the sludge; the solids added (in pounds per capita per day); and the temperature difference between the incoming sludge and the temperature at which it is desired to hold the tank contents during the digestion period. With these three variables known, the heat requirements for the sludge additions can be rapidly found through the use of the nomograph. The percent of solids in the sludge and the solids added per capita per day are variables which depend upon the treatment method used. For the sake of simplicity, numerical values of percent solids and solids added for generally used treatment methods have been indicated on the nomograph by the key letters A through H, and the corresponding treatment methods are listed in the table on the nomograph sheet.

Steps in Solution

Step 1. Find "Percent Solids in Sludge" for the treatment method used and connect with scale "Δ temperature."

Step 2. Note the intersection of this line with the diagonal transfer scale.

Step 3. Connect the "Solids Added" (lbs/capita/day) with the point previously found in Step 2 on the transfer scale, and extend to scale marked "Heat Required for Sludge Additions" (BTU/hour/1000 Population).

The value found in Step 3 above, multiplied by 24 hours and the number of 1000's of population will yield the heat requirements for the sludge additions for a 24-hour period.

Sample Solution

An example of the use of the Heat Requirements nomograph in the solution of a typical problem is illustrated by the red lines.

Assumptions: Raw sludge temperature = 50°F; temperature in digester desired = 90°F; temperature difference = 90 — 50 = 40°F. The digester is to be used for an activated sludge treatment plant. From table in center of graph note that values A and F are used with this type of treatment.

Step 1. Find value A on "Percent Solids in Sludge" scale. This equals 6.6 percent.

Step 2. Find value of "Temperature Difference." As shown above this equals 40°F.

Step 3. Connect points found in Steps 1 and 2 and note intersection on diagonal transfer scale.

Step 4. Find value F on "Solids Added" scale. This equals 0.15 lbs/capita/day.

Step 5. Connect point found in Step 4 with point noted on transfer scale in Step 3 and extend to intersection with scale "Heat Requirement for Sludge Additions." This equals 4,600 BTU/hour/1000 population.

To this value must be added the heat losses through the walls, bottom, and cover of the tank through a corresponding temperature difference and the heat losses in transferring the sludge from the heating device to the digester. The sum of these three values will give the required heat necessary to maintain the digester at the desired temperature.

• • •

Morton Arboretum To Help In Fight Against Dutch Elm Disease

The Morton Arboretum is now able to accept a limited number of culture plates of elm wood chips which have well-defined fungus growth on them. It is not possible to accept diseased twigs for culture. Plates will be inspected twice a month by a member of the Illinois Natural History Survey Staff. The Arboretum is located near Lisle, in DePage County, 25 miles west of Chicago on Illinois State Highway 53.

It is comparatively simple and cheap to convert a small room into a laboratory for the purpose of growing chips of diseased wood in culture plates. Communities wishing to obtain more information about this matter should write to the Morton Arboretum, Lisle, Illinois, enclosing a stamped self-addressed envelope.

TELEMETERING COORDINATES

ORMAND A. STONE

Forrest and Cotton,

Consulting Engineers,

Dallas, Texas

THE NORTH TEXAS Municipal Water District, consisting of ten member cities, and the City of Dallas as a customer, was formed to utilize water from the Lavon Reservoir on the East Fork of the Trinity River about twenty-five miles northeast of Dallas. The Lavon Reservoir was constructed by the Corps of Engineers as a flood control and water conservation project. The conservation storage in the project of 100,000 acre-feet is available to the District through a contract with the Government. The ten member cities which are situated in four separate counties are Plano, McKinney, Princeton, Farmersville, Wylie, Garland, Rockwall, Royse City, Mesquite, and Forney. The City of Dallas, while not a member of the Water District, has contracted to purchase water from it.

The cities are supplied with treated water through a network consisting of 92.4 miles of pipe. The water is pumped to a central treatment plant in the northeast edge of Wylie, about 3 miles from the Lavon Reservoir and thence distributed through a pipe network ranging in size from 12 inches to 48 inches. The District has also constructed nine ground storage tanks and four booster pump stations.

Construction

Construction of the 90-mile pipe line network involved acquiring 325 easements. About 50 acres of land were acquired for the treatment plant and terminal storage sites, varying in size from 1.81 acres to 24.57 acres.

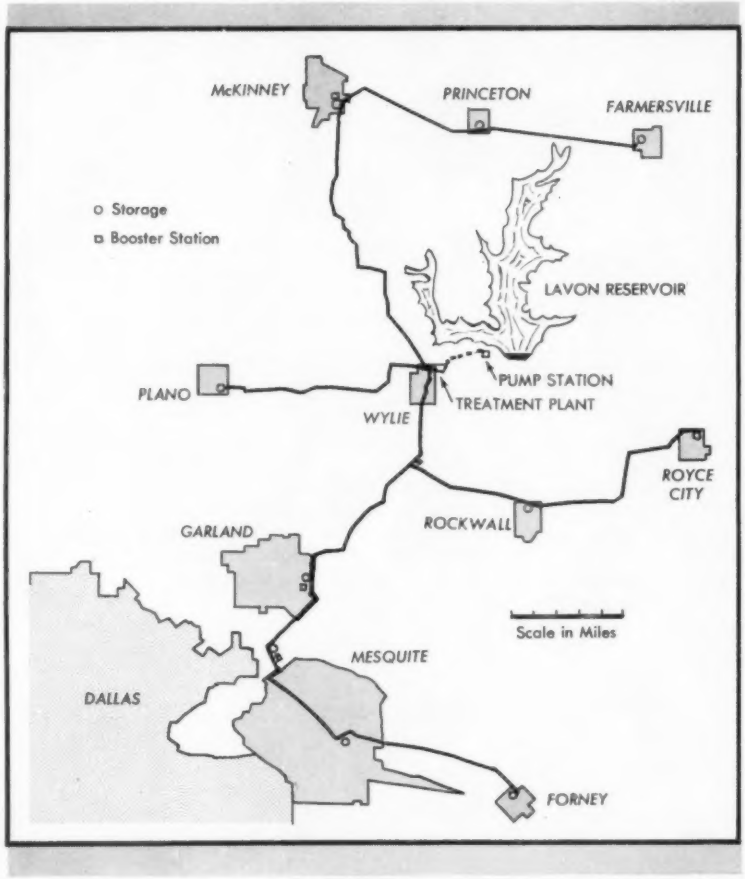
All construction having to do with the operation of the system was substantially complete on March 15, 1957. The total value of work included in the twenty-three separate construction contracts was $7,018,177.64.

Favorable prices with respect to pipe line construction made it possible to increase the size of certain elements of the system. For example, it was possible to use a 48-in. raw water supply line instead of the 42-in. originally planned. The Wylie-to-Garland leg was increased from 36-in. to 42-in.; and Garland-to-Dallas, from 30-in. to 36-in. pipe.

Savings in construction costs also made it possible to increase storage tank capacities at most of the terminals. A comparison of the storage tank sizes originally anticipated and the sizes actually installed is as follows: The tank at Dallas was finally built to a 3.5-million gallon capacity instead of 3 mg; that at McKinney was increased from 1.5 mg. to 2.0 mg. Several of the smaller ones were doubled.

Control Circuit

The selection of the control circuit for remote operation of the widely separated stations was the object of considerable study. Factors influencing the final decision were initial cost, expected maintenance, maintenance responsibility, reliability, and the feasibility of providing additional functions as required. Transmission media investigated included standard radio communication channels, microwave, private lines for burial in the easement of pipe lines, and leased telephone circuits. Consideration of all factors led to the selection of leased



● **NORTH TEXAS Municipal Water District serves ten cities and part of Dallas.**

TEN-CITY WATER SYSTEM

telephone circuits for control after firm rates had been obtained from the telephone companies involved. These rates included some construction costs which would have made other systems more competitive if there was a possibility of early cancellation of the proposed service. Use of the circuits up to ten years rendered the construction costs negligible.

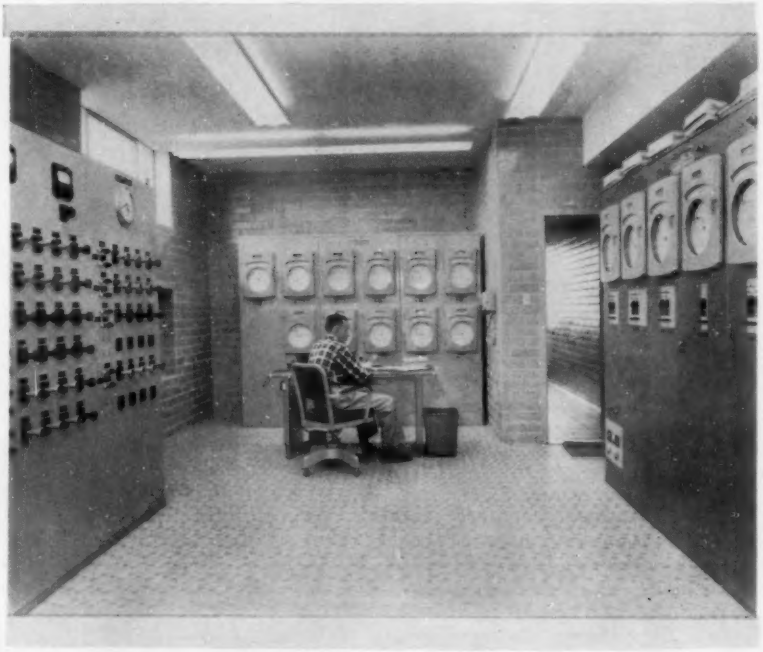
Since the control circuits were to pass between cities, in most cases it was necessary to use audible signal frequencies which could be carried and repeated through the standard carrier equipment of the telephone company, which does not offer continuous metallic wire circuits for that purpose. These circuits are classified as "voice quality" circuits and can transmit frequencies from 300 cps to about 3000 cps. Tones selected for control and telemetering use were from within this band. Audible tone equipment was available from the phone company at a rental rate or could be purchased from the control equipment manufacturers. The decision was made to purchase the equipment direct along with the control equipment, providing a clear-cut division of maintenance responsibility, physical location of equipment and more compact and easily accessible wiring.

Control Equipment

Investigation of available equipment for control led to the selection of a Builders-Providence system. Considerable importance was placed in one manufacturer being responsible for all components involved in metering and control circuitry, including panel mounting and wiring of all instruments, tone units, relays and switches involved.

The control circuits, as far as operation is concerned, are divided on the central control panel into north, south and east transmission lines. There is no actual control function in a westerly direction. The city of Plano, to the west, is supplied by water with pump control located in the control room. Report back from the Plano reservoir is accomplished by simple dc telemetering of reservoir level, which is indicated and recorded in an instrument on the plant instrument panel. The north transmission line controls pumps at McKinney, and positions a valve at Princeton; the south transmission line controls pumps at Garland and pumps at Dallas; and the east transmission line controls two pumps at Elm Grove Road, one for pumping to Rockwall and the other to Royse City. Control of a valve at Rockwall can isolate the Rockwall reservoir and allow water to be pushed on to Royse City.

Although control is accomplished in three different directions, only two telephone circuits are used. With minor changes in the equipment, it was possible to combine the north and south control circuits effecting further reduction in the monthly rates involved, largely because it required fewer pairs of wires leading to the central control panel. This combining of circuits was accomplished by using a Builders-Providence Synchro-Scan control system on the south leg where considerable future expansion is anticipated. Future demands may call for a booster pump station between Wylie and Garland, and additional pumps at Garland and Dallas. Synchro-Scan, as purchased, can provide these additional functions and report-back features without interrupting or disturbing the existing control functions. Provisions have been made on the central control panel to receive these anticipated future requirements.

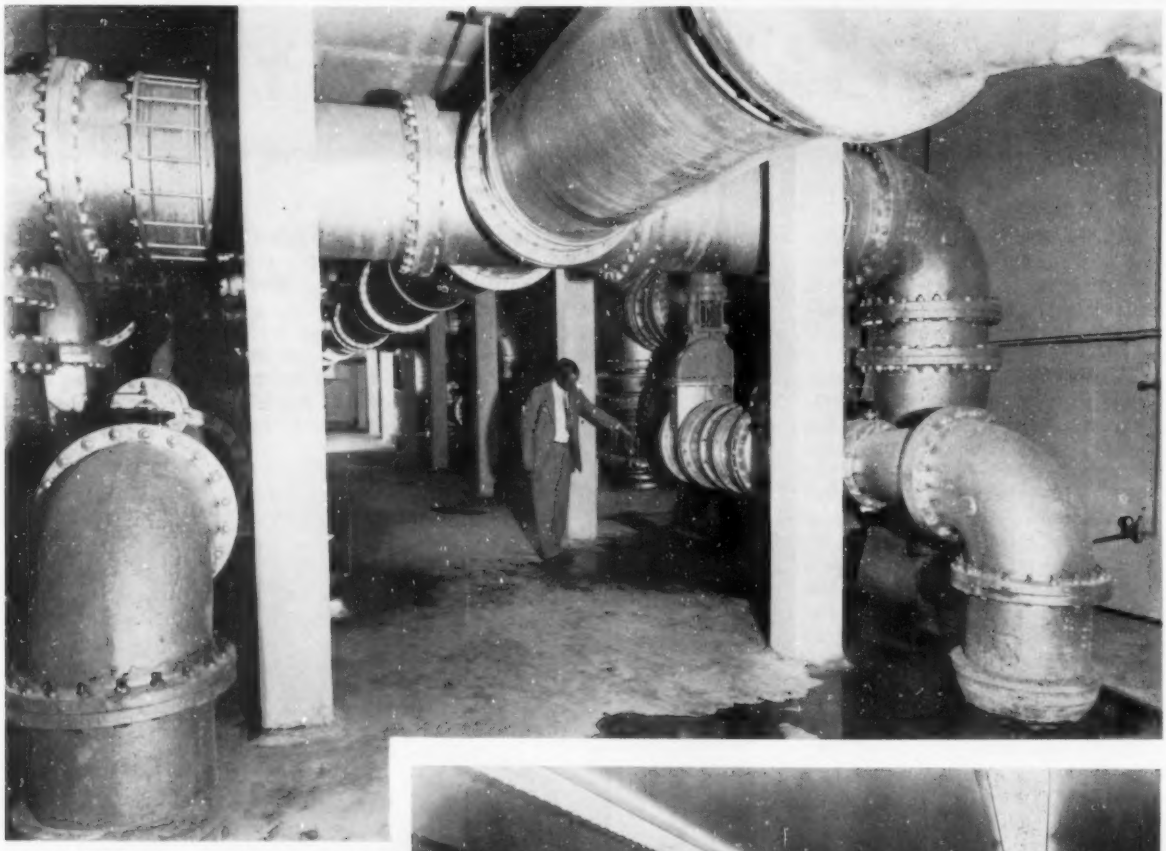


● **CENTRAL CONTROL and telemetering panel is located at Wylie. Control is accomplished in three different directions to regulate pump operations and valves.**

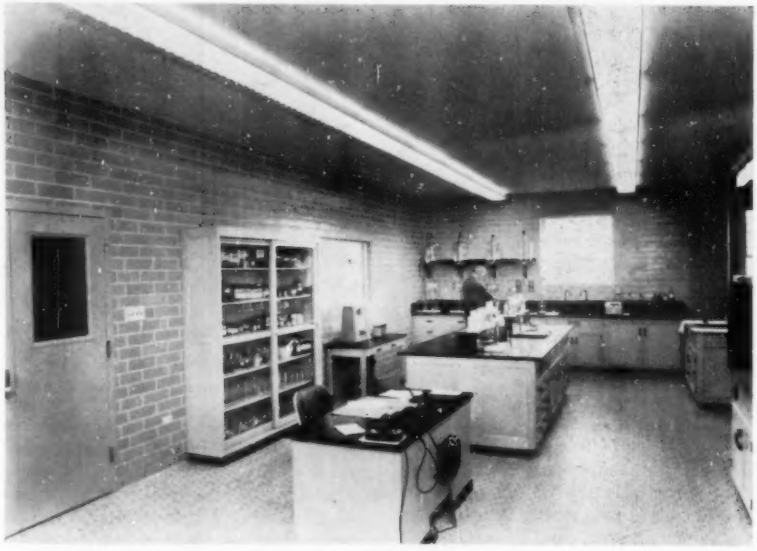
Control on the north transmission line is accomplished with instant response tone units for each function. Pumps run with tone on and stop with tone off. Report back of pump operation is accomplished in the same manner in the opposite direction. All telemetering is continuous and is independent of control functions. Provisions have been made in all flow instruments for the addition of telemetering flow back to the central panel if desired by the district later.

Treatment Plant

The District's water treatment plant at Wylie has a nominal out-



● **FLANGED cast iron pipe was used in the filter gallery, with some Dresser couplings at strategic locations.**



● **WELL-EQUIPPED laboratory is one of the features of the treatment plant. It is fully equipped for chemical and bacteriological examinations and controls.**

put capacity of 20 mgd based on a 2 gpm per square foot filter rate, with provision for doubling this capacity later. The flow through the existing units can be stepped up to a 40 mgd rate, if necessary.

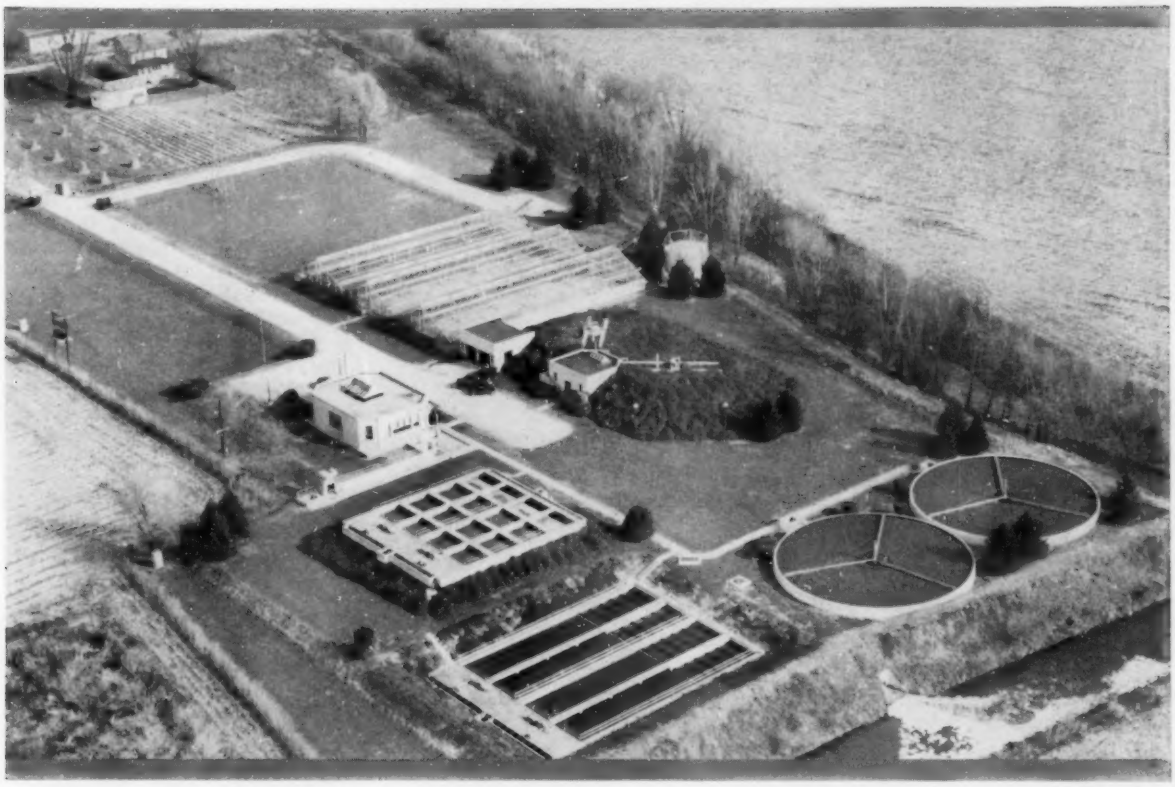
Two Dorr-Oliver clariflocculator units, each 170 feet in diameter and with a 14-ft. S.W.D., provide a 60-minute flocculation period and about 4½ hours settling of the lime-softened lake water, with the plant operating at nominal capacity. Sludge is withdrawn continuously from the units through an hydraulically operated, electric timer controlled, Grinnell-Saunders valve set at such an elevation as to assure a velocity of 8 fps in the 6-inch cast iron sludge withdrawal line.

Filter Design

The filter units are of the conventional center gullet type with 4-inch C.I. underdrains. Three units, each having a sand area of 1,150 square feet are located on either side of the pipe gallery. Filters are uncovered. All exposed piping of the filter gallery is flanged cast iron. Hydraulically operated gate valves are used throughout, with valve position indicators on the operating tables electrically operated from a 6-volt circuit. A pneumatic master control system, operated from the water level in the settled water conduit in the filter gallery, maintains a uniform height of water in all filter basins. Rate of flow controllers and the master control were furnished by B-I-F Industries.

Waste water and filtered water piping—beneath the pipe gallery floor—are reinforced concrete. Filtered water storage is provided by two 160-foot diameter reservoirs, each having a capacity of 2½ million gallons.

A well equipped chemical and bacteriological laboratory and the central control room from which the District's many pumps are operated are features of the plant.



The Operation of SEWAGE TREATMENT Plants

Revised and Expanded by

KENNETH W. COSENS,

Associate Professor of

Sanitary Engineering,

The Ohio State University

A SEWAGE TREATMENT plant is designed, constructed and operated to protect the public health and to prevent nuisance. A treatment plant is expensive to build, maintain and operate. The best planning, materials, and equipment should be incorporated into it. Likewise, it should be operated so as to provide the maximum return on the investment in it. The operator should be skilled in his work and he should be paid in accordance with his skill. This article is intended to provide basic information and reference data for the operator, and to act as an introduction to modern textbooks and literature which consider those factors that enter into treatment plant operation.

It should not be necessary to state that a plant should be kept clean and attractive; that the area around it should be covered with good grass, kept mowed; that equipment should be maintained in clean and good operating condition; and that buildings and, where applicable, equipment should be kept freshly painted. It is also obvious that the operator ought to have office space where he can keep his records; a laboratory where he can perform the necessary tests and examinations; and a suitable lavatory, shower, toilet and working clothes storage facilities.

Measuring Flow, Concentration and Temperature

In measuring flows of sewage, the U. S. gallon is used almost invariably. This is not the same as the Imperial gallon used in Canada and England. The Imperial gallon equals 1.20 U. S. gallons, and the U. S. gallon is 0.83 as large as the Imperial gallon.

Sewage flows are usually measured in millions of gallons per day, abbreviated "mgd." For instance, 1,875,000 gallons per 24 hours is written 1.875 mgd; 250,000 gallons per day is 0.25 mgd. When considering pump discharge or pump

Courtesy Metalab Equipment Co.

● **ATTRACTIVE and well-planned laboratory of the Grand Rapids sewage treatment plant. Laboratory control is essential in getting proper plant operation.**

capacity, gallons per minute (gpm) is frequently used. It is convenient to remember that 700 gpm is very nearly equal to 1.0 MGD.

Cubic feet per second (cfs) is used to measure flows in most sewer systems, usually in those carrying storm water; and also the flow of streams. A flow of one cfs equals 0.646 MGD.

The metric system has no application in this country to the flow of sewage, but it is commonly used in laboratory work. It is seldom necessary to convert the metric units to pounds, feet and gallons; when conversion is necessary, it can best be accomplished through the familiar "parts per million" (ppm). However, a brief outline of the metric system will be given in the following paragraphs.

The basic unit of volume in the metric system is the liter, which equals 1.06 US quarts. There are 1,000 milliliters (ml) in a liter. Older texts refer to cubic centimeters (cc); for all practical purposes these are the same as milliliters. A liter of water weighs 1,000 grams under standard conditions of temperature and purity; and 1,000 grams equals a kilogram, which is about 2.2 pounds.

In laboratory work, the milligram (mg), which is one-thousandth of a gram, is the smallest unit of weight normally used. The milligram is one-millionth of a kilogram, the weight of a liter of water. Therefore, one milligram in one liter is one part per million, and it is expressed as mg/l. The use of mg/l instead of ppm is to be encouraged, as it represents a true expression of the concentration.

It is a little more complicated to get parts per million when using our U. S. terms. Since one gallon weighs 8.33 pounds, a million gallons weigh 8,330,000 pounds, and one ppm or mg/l is 8.33 pounds per million gallons.

When using some chemicals, especially those used in water treatment, the term grains per gallon (gpg) is often used. In the usual avoirdupois pound there are 7,000 grains—not to be confused with the grams of the metric system. Therefore one grain per gallon means one pound in 7,000 gallons; and 1,000,000 divided by 7,000 is 143 lbs. per million gallons. Since 8.33 pounds per million gallons equals one mg/l, 143 divided by 8.33 gives 17.1; and one grain per gallon is the same as 17.1 ppm (mg/l) or 143 lbs. per mg.

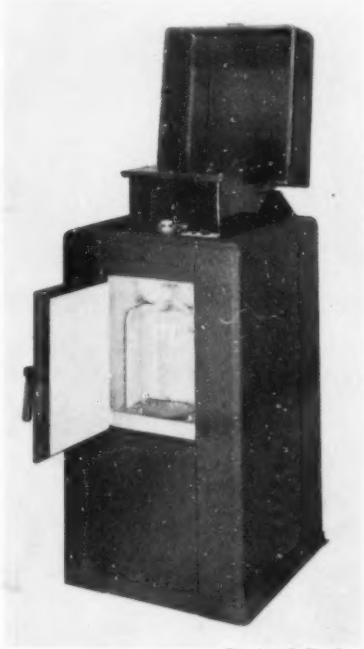
There are two common methods of measuring temperature, Fahrenheit (F) and Centigrade (C). The F scale is commonly used for everyday reference to the weather; the C scale is used for most scientific work. In the F scale, freezing is at 32° and boiling at 212°, a difference of 180° between freezing and boiling. In the C scale, freezing is at 0° and boiling at 100°. Note that there are 100 units between freezing and boiling on the Centigrade scale and 180 degrees or units between these same limits on the Fahrenheit scale. The degree F is therefore 100/180 = 5/9 of a degree C.

To convert from F to C, follow the example: 140°F = ?°C; (104 — 32) = 72°F above freezing, 72 x 5/9 = 40°C above freezing equals 40°C. To convert 30°C to F; 30 x 9/5 = 50°F above freezing, then 30°C = 54 + 32 = 86°F. The operator should be familiar with both systems of measuring temperatures.

Texts and Reference Data

A laboratory and some laboratory equipment are required for every sewage treatment plant. It is not necessary that the laboratory be large or the equipment costly. What is needed depends upon the tests that need to be performed and these depend, in turn, on local conditions. A recommended set of laboratory equipment and a suggested layout for a laboratory can be obtained from your state sanitary engineer.

There are two books that are essential to the sewage treatment plant operator. These are: (1) *Standard Methods for the Examination of Water, Sewage, and Industrial Wastes* (10th Edition); and (2) *Analysis of Water and Sewage*, by Theroux, Eldridge and Mallmann. Other useful texts are, *Principles of Sewage Treatment*, published by the National Lime Association; *Manual for Sewage Plant Operators*, published by the Texas Water and Sewage Works Association; and the SEWERAGE MANUAL published by this magazine. The procedures for the various tests are outlined in a simple form in several of these texts.



Courtesy Infilco Inc.

● **SAMPLES must be truly representative. This device samples at specified intervals on basis of volume of the flow.**

Sampling Sewage For Analysis

If samples are collected improperly and do not give a true

representation of the sewage to be tested, the analyses will be largely worthless, no matter how carefully made. Heavy solids may move along near the bottom of a channel, lighter ones near the top; all must be included to get a true sample. Samples may be "catch" or "grab", that is, a single pail, dipper or bucketful; or they may be "composite", which is the combination of samples taken every hour or half-hour for 24 hours, proportionate in volume to the flow at the time of sampling.

Tests for dissolved oxygen (DO) and pH must be made on fresh catch samples. Special equipment and care must be used in taking DO samples to prevent admixture of additional air with the collected sewage. Grab samples may be used for obtaining operating data, but results from them are subject to considerable variation. Composite samples should always be taken at sufficiently frequent intervals to provide adequate checks.

Courtesy Beckman Instruments, Inc.

● **pH METER is electrically operated, but pocket size for field and plant use.**

Directions for taking and preserving composite samples over the 24-hour period are detailed in the books listed previously. The use of automatic samplers saves much time and simplifies the problem. These will take samples proportional to the volume of sewage flow and store them in a refrigerator, mixed and ready for analysis. Several of these were illustrated and described in the most recent edition of the SEWERAGE MANUAL.

In taking catch samples to show the results of treatment, allowance should be made for the time required for the sewage to pass through the treatment plant units. For instance, if the grab sample of raw sewage is taken at 8:30 am, and if the detention time in the primary settling tank is 3 hours, the sample of the primary tank effluent should be taken at 11:30 am. There is usually some short-circuiting, however, and the actual detention may be less than the theoretical. It is desirable to take, at hourly intervals, a series of grab samples of the raw sewage and the effluent from a settling tank, and to plot these on cross-section paper. If the samples are taken during periods of low, average and high flows, the operator will learn a great deal about the operation of his settling units.

When planning a sampling program, look the situation over and use judgment in order to get samples that are representative. Utilize your own knowledge of your plant. Exclude large solids. A 2-quart enameled dipper is handy for catch or grab samples. Tests should be made promptly, in general within 2 or 3 hours after the samples are taken. Read the sections on sampling in texts 1 and 2 already listed. *Planning and Making Industrial Waste Surveys*, published by the Ohio River Valley Water Sanitation Commission also will be helpful in getting an understanding of the principles of sampling.

Laboratory Determinations

An analysis of a sample of sewage may show the following results:

Total Solids	980 mg/l
Volatile Solids	600 mg/l
Non-Volatile Solids	380 mg/l
BOD (5-day)	230 mg/l
pH	7.0

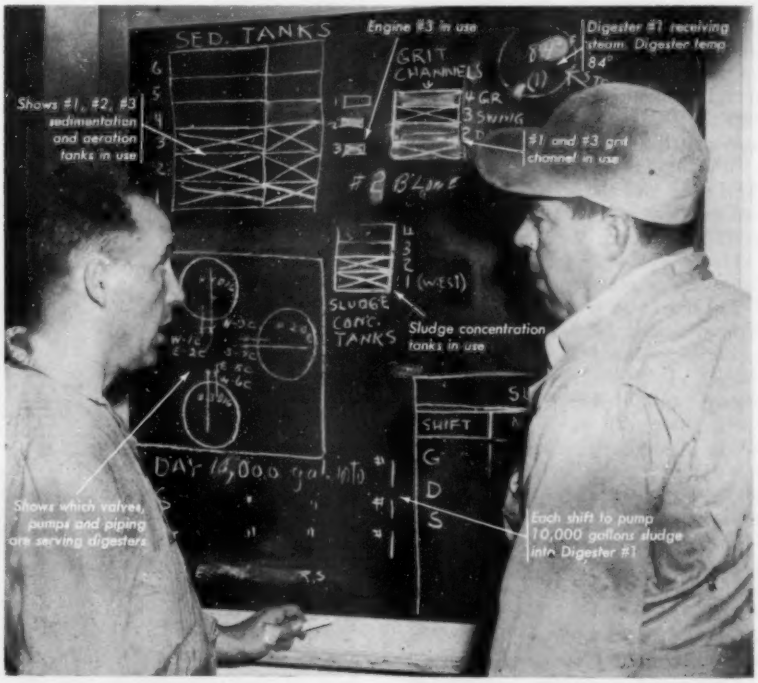
What do these mean in terms of what one should know in order to operate a plant?

Total Solids. This means just what it says— the total dissolved and suspended solids in the sewage sample indicated above is 980 mg/l, that is, in a million pounds of this particular sewage there are 980 pounds of dry solids, for all solids are measured on a dry basis. In a million gallons of this sewage, there will be, since a gallon of sewage weighs 8.33 pounds, 980 times 8.33, or 8,167 pounds of dry solids.

These solids should be classified further, if we want to know what the sewage contains. Some of the solids will be inorganic, as grit and sand; and some will be organic, as feces, pieces of vegetables, etc.

The grit and sand, and such mineral compounds as carbonates, sulfates, etc., are called non-volatile or inorganic solids. These will not digest or decompose. The organic material mixed with such grit and sand, unless carefully washed out, may make this material odorous after it has been removed from the sewage. It is the organic or volatile solids that give the operator his job and most of his troubles.

To show how small the proportion of solids in sewage actually is,


SED. TANKS
Engine #3 in use
GRIT CHANNELS
Digester #1 receiving steam. Digester temp 84°
Shows #1, #2, #3 sedimentation and aeration tanks in use
#1 and #3 grit channel in use
SLUDGE CONC. TANKS
Sludge concentration tanks in use
SHIFT
DAY 14,000 gal. into #1
Shows which valves, pumps and piping are serving digesters
Each shift to pump 10,000 gallons sludge into Digester #1

● **SHIFTS come and go; and the incoming men need to know quickly the engines, pumps and other equipment that are being used. "Status" board helps orientation.**

Courtesy Chain Belt Co.

● **GRIT removal is essential in modern sewage treatment. Mechanical removal is much more efficient than older methods and may reduce labor costs very materially.**

the 980 mg/l representing 8,167 pounds in a million gallons, amounts to only about 13 ounces in 100 gallons.

The total quantity of solids in a sewage is found by evaporating to dryness a known volume of the sewage and weighing the dry residue. A sample of 100 ml is generally used. Detail methods of performing the test are given in the texts already listed and will not be described here. A further step in this test, heating the residue to a red heat (igniting), drives off most of the volatile or organic matter, so that the total solids, the volatile solids and the inorganic solids are all determined.

Suspended and Dissolved Solids. Some of the solids in sewage are dissolved, as sugar is dissolved in coffee. Needless to say, these are difficult to remove. They represent about 60 percent or even more of the total. Other solids are colloidal in nature, actually so finely divided that they will not settle out of the sewage in a settling tank.

Other solids are floating on or in the liquid and these are called suspended solids. A part of these, usually no more than half, can be removed by settling. In the analysis given, suspended solids amount to 270 mg/l. A settling tank should remove about 50 percent of these, and the effluent from a primary settling tank treating this particular sewage should show, on analysis, about 130 to 140 mg/l of suspended solids. Actually this will depend on the condition of the sewage; less will usually be removed when the sewage is stale.

Settleable Solids. This test measures the amount of material that will settle during a quiescent period, usually one hour, and is applied to primary or final tank influents. The amount settled may be considered as approximating the amount of solids that can be removed by ordinary sedimentation. Two or more Imhoff cones are used. These hold 1 liter; they are filled with well-stirred sewage and placed in a holder. After about 45 minutes, the cone is rotated gently or stirred carefully, reversing the direction of rotation or stirring 3 or 4 times. The gentle movement permits material clinging to the sides of the cone to move down and also levels out the material at the bottom. After 15 minutes additional settling, the amount of material settled may be read roughly by the graduations at the bottom of the cone. The weight method involves determining the suspended solids before and after a 1-hour quiescent period, the difference being the settleable solids, which would be reported in mg/l.

The test should be made at the same hour each day and in the same manner. Adopt a standard operating practice and follow it. This should include washing the cones with a good detergent and water and a long-handled brush after each use. If not washed carefully, a thin layer of grease may collect on the interior and interfere with the settling process and the reading operation.

Bacteriological Tests. Bacterial removal is given scant consideration in most sewage treatment plants. Sewage, as it reaches the plant, may contain almost unbelievably large numbers of bacteria—a hundred million or more per ml. The treatment process reduces the number, but the plant effluent still contains a great many bacteria. Except in unusual cases, where the effluent is heavily chlorinated in order to protect waters containing shellfish, or for some other sanitary purpose, no attempt is made to control the numbers of bacteria. Therefore, bacterial tests are not routinely made in sewage plant operation.

BOD. These three letters are a simple way of writing Biochemical Oxygen Demand. The BOD of a sewage represents the amount of oxygen necessary to stabilize the decomposable organic matter and a measure of the organic material present in a waste.

Organic matter in sewage may be determined approximately by at least two methods. One test is dependent upon chemical oxidation and the other is dependent upon bacterial oxidation. The first is known as the COD test and oxygen is supplied by potassium dichromate, the second is known as the BOD test and oxygen is supplied by the oxygen in a standard dilution water.

The BOD of the sample considered above was 230 mg/l. This means that 230 mg/l of oxygen are necessary to satisfy the demand of

Courtesy Simplex Valve & Meter

● **HOW MUCH flow? A parabolic flume provides simple accurate measurements.**

the organic matter present during a stated period (five days is the BOD period unless otherwise indicated). Remembering that 1 mg/l equals 8.33 pounds per million gallons, there must be utilized by this sewage, in order to stabilize it, 8.33 x 230 or 1,916 pounds of oxygen per million gallons. It is the purpose of the various treatment devices discussed later to supply this oxygen.

As a matter of fact, it will take more than 1,916 pounds of oxygen. To accomplish nearly complete stabilization of the organic matter requires several weeks. This is too long a period over which to run tests, and results obtained 3 or 4 weeks after the sample is taken are not of much value in guiding operation. Therefore in testing work, the results at the end of 5 days are usually taken. The BOD of 230 shown is the standard 5-day result. Experience has shown that under most conditions, the 5-day BOD is about 68 percent of the final BOD of a sample.

Different treatment processes, while producing effluents yielding similar 5-day BOD results, may not be wholly comparable. An example is the high rate trickling filter as compared to the standard or low rate trickling filter. The high rate filter does not accomplish the same degree of nitrification that the low rate filter does, but this is not shown in the 5-day BOD result since nitrification does not take place under the test conditions during the 5-day period.

The presence of chlorine makes the results of BOD tests unreliable. The chlorine must be neutralized, and the sample seeded to get reliable results as described in the texts previously cited.

The collection of representative samples is important, and 24-hour composite samples are necessary for accurate results. Short-time composites, as from 8 am to 4 pm, usually give results that are too high on the raw sewage and too low on the effluent, thus presenting an unduly favorable picture.

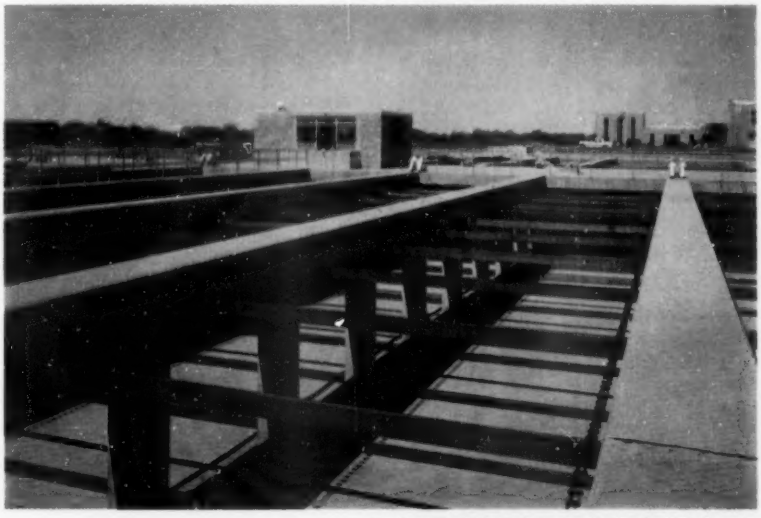
As already stated, the standard BOD test is the 5-day test. Much work has been done on the development of shorter and simpler tests; but none of these has so far gained acceptance. The BOD test employs very small quantities of sewage. Good technique and considerable care are required for accurate results. It is recommended that operators arrange with their state sanitary engineer for instruction, preferably taking one or more of the short courses provided, usually at a State University.

What pH Measures. The pH of a solution is a measure of the *intensity* of *acidity*, or of its opposite *alkalinity*. It measures the *pressure* tending to create a chemical reaction. The term *alkalinity*, when used in connection with pH, should not be confused with the use of the same term to denote the amount or weight of certain dissolved alkaline minerals in water. It should be noted that alkalinity and acidity in water or sewage are amounts of acids or bases present and are measured in mg/l while pH is measured on an arbitrary scale from 0 to 14, and is a measure of chemical activity or intensity. On this scale, 7 is neutral; 6 is acid; 5 even more acid, etc. On the upper half of the scale, 8 is alkaline, 9 even more alkaline, etc.

Determinations of pH are valuable in sludge digestion, sludge filtration, chemical precipitation prior to settling and in laboratory control of plant operation. A daily record should be made at a regular hour each day, and additional tests are desirable at different hours in order to check variations.

Probably the most important use of such daily pH records is to detect high acidities or alkalinities in sewage which might adversely affect the sludge digestion process. The discharge of industrial wastes, whether due to accident or design, may so modify the sewage characteristics as to upset plant operation. Timely warning will permit remedial measures to be applied and the defect to be corrected. Any marked variation in pH from normal ranges should be investigated at once.

The pH value can be obtained by the use of indicators and a color scale, or by the use of electrical pH equipment utilizing two electrodes, one glass and the other saturated calomel. pH meters are of special value in sewage analysis work where turbidity or color may make determination by the colorimetric method difficult. pH indicator papers may be used for less accurate work and for work where pH meters cannot easily be used.



Courtesy The Ohio State University, Dept. of Photography

● **SLUDGE COLLECTORS and scum removal equipment of the chain type used in rectangular tanks are shown in this picture of additions to the Columbus, Ohio, plant.**

Dissolved Oxygen. The presence of dissolved oxygen in raw sewage is an indication of freshness; or it may indicate considerable ground water infiltration. Unpolluted surface waters usually contain as much dissolved oxygen as the temperature will permit, varying from about 14.6 mg/l at freezing to about 7.6 mg/l at 30°C or 86°F. Therefore, the amount of dissolved oxygen in a stream may be a valuable indicator of its ability to receive, without nuisance, an additional load of organic matter.

Residual Chlorine. When sewage is chlorinated, the amount of chlorine required is determined by the residual remaining in the sewage after 15 minutes contact. Experience has shown that if there is a residual of as much as 0.5 mg/l after 15 minutes, the dosage of chlorine is satisfactory.

Standard Methods describe four tests for chlorine residual in sewage: 1. Amperometric titration; 2. starch-iodide; 3. orthotolidine;

and 4. spot plate test for field use. The last two involve the use of orthotolidine as an indicator and require color standards for comparison. Turbidity may cause difficulty in the color comparison method. The first method listed requires the most expensive equipment but is most accurate of all the methods.

When chlorine disinfection is used, the test for residual should be made daily, or more frequently, and at a standard time, and the results recorded. A suitable point for taking the sample of sewage should be selected which (1) is truly representative; and (2) provides the desired contact time. Occasional check samples at other places may be desirable.

Methylene Blue Test. This test, more frequently called the relative stability test, represents the length of time that elapses before the sewage putrefies. It cannot be used on sewages that have been chlorinated because the chlorine destroys the organisms which decolor the methylene blue. When sewage is chlorinated the sample to be tested should be taken ahead of chlorination.

This test is an approximation of the BOD test, but results from it cannot be converted into BOD results. The methylene blue dye is purchased already prepared, ready for use. Follow the directions in Standard Methods or in Theroux, Eldridge and Mallmann in making up the bottles, which are held at 20°C (68°F) until the blue color disappears. Methylene blue is blue in the presence of dissolved oxygen and colorless in water devoid of oxygen. The length of time required for decoloration indicates roughly the degree of stabilization — the longer the better or more stable.

How to Report Tests. For all results except those for nitrogen, results are reported as follows: For mg/l between 0.1 and 1, use two decimal places, as 0.55; between 1 and 10, use one decimal point as 5.4; between 10 and 100, use the nearest whole number, as 43; over 100, use only two significant figures, as 130, not 134. When reports are tabulated, do not place zeros at the right of the decimal point to fill out and balance columns.

Purposes Of Treatment

It is not practical to remove all of the solids from sewage by any treatment processes, nor is it necessary. In most plants, the total solids are reduced only 25 to 40 percent. Settleable solids and BOD are greatly reduced—as much as 85 to 90 percent—by complete treatment. What is important is to change over the remaining solids into relatively stable forms, thus removing very largely their trouble-making characteristics. Thus, the sewage treatment plant is designed to: (1) Remove suspended solids, both organic and inorganic to a reasonable extent; (2) convert the remaining organic matter into stable forms that will not further decompose; and, when needed (3) disinfect the effluent for control of pathogenic organisms.

The objective of sewage treatment is to reduce, quickly and inoffensively, the complex organic matter in the sewage to simpler and more stable compounds.

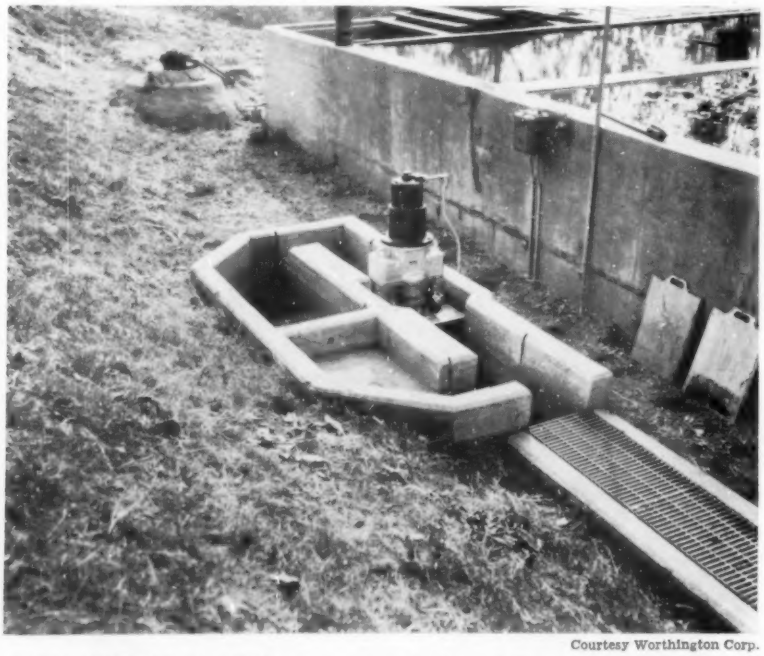
Operation Of Grit Chambers

All sewage carries in suspension some sand, grit, and cinders. Even in the small plant treating only ordinary domestic sewage, a considerable amount of inorganic material arrives with the sewage. This may make the sludge hard to handle, and when sewage is pumped, such material causes rapid wear in the pumps. Sand or grit may also clog or interfere with the working of valves and gates. Grit removal is an essential part of a treatment plant wherever there is any mechanical equipment that in any way moves through the sewage or that pumps the sewage. It is desirable that grit be removed as early in the process as possible.

Removal Methods. The sand and cinder particles, being heavier, will settle more quickly than the organic matter in the sewage. Removal is therefore accomplished by briefly reducing the velocity of the sewage to about 1 foot per second, at which velocity the sand and other grit will settle, while the organic matter does not.

The flow of sewage varies, being larger during the day than at night. It is therefore difficult to provide a grit chamber that will have the same desirable velocity for all volumes of flow. In older designs this was partially accomplished by providing two or more channels or compartments, one or more of which were used, depending on the volume of flow. In newer designs, mechanical units are provided which automatically care for the normal variations in the flow. These include the Dorr Detritor, and the Link-Belt straightline grit collector and the Jeffrey and Chain Belt units. All of these provide for mechanical removal and washing of the grit, so that the material removed is relatively clean and unobjectionable.

Operation. When modern mechanical equipment is used, operation consists of (1) final disposal of the washed grit, which can be used for fill; and (2) lubrication and maintenance of the equipment in accordance with the manufac-



Courtesy Worthington Corp.

● **COMMINUTOR installation for a small plant. Inflow is from left; by-pass screen is shown for emergency use. Gates to divert flow are available at right.**

turer's directions for this work.

In the older types of grit chambers, cleaning is necessary after every storm, and also when it is determined by measuring with a pole marked to feet and inches, that the channels are half full or more. In dry weather, measurements should be made once a week. Removal is accomplished by shutting off the flow in the compartment or channel to be cleaned, pumping or bailing out the sewage, and removing the residue with shovels, pails or, in large plants, with grab buckets. Such grit usually contains so much organic matter that it should be buried; but if sufficient space is available it may be dried on sludge beds at some risk of causing odors.

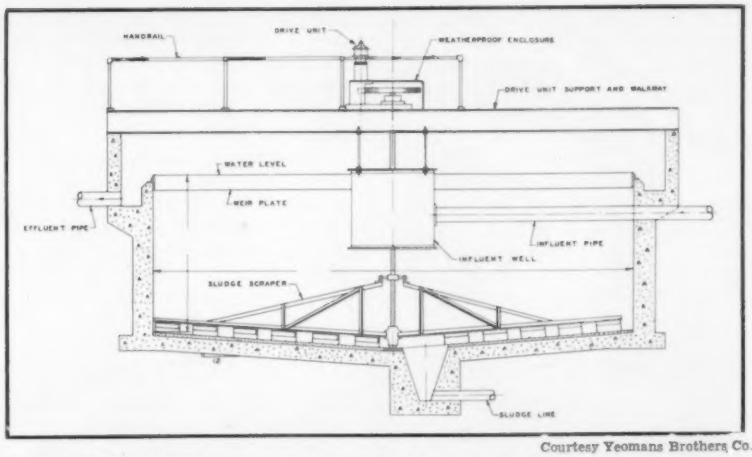
One thing is obvious, and that is the fact that if the grit is not removed from the grit chamber it will ultimately show up in the sludge digester, and most operators know that grit does not digest well. If the operator is fortunate enough to have a grit chamber as part of his treatment facilities, he should set up an adequate schedule for the removal of grit from the grit chamber and dispose of it in a way that it will not become offensive to the community. If he does not have one, he should exert every effort to have a mechanical unit installed. These are described and illustrated in the SEWERAGE MANUAL.

Operating Records. When mechanical washing and removal apparatus is used, a daily record should be made of the amount, generally in cubic feet, of material removed. This may be entered on the daily report in the column adjacent to the volume of flow and to the volume of screenings. When grit chambers must be cleaned by hand, the dates of cleaning and the amount of material removed should be noted; also days since last cleaning and notations regarding storms.

Operation Of Screens

The purpose of screens is to remove these large objects from the sewage which tend to clog pumps and pipe lines and to interfere with plant operation. The term "screens," as used here, refers to permanently mounted racks or screens made of iron bars spaced one-half inch or more apart. The bars are usually set at an angle to facilitate cleaning. Hand cleaning is a disagreeable job, often neglected; mechanically cleaned screens are therefore very preferable.

Type of Screens. There are several types of mechanically cleaned screens made by Link-Belt, Dorr, Jeffrey, Chain Belt and others. In addition to convenience and economy, mechanically cleaned screens are more effective than hand-cleaned screens because cleaning is more frequent. In the small plant, screens are normally raked by hand only once or twice a day, whereas the mechanical screen can be set by a timing device to operate as desired, at 3, 5, 10, 30 or 60 minutes. As a result, about twice as great a volume of screenings is removed and the load on following units of the plant is correspondingly reduced.



Courtesy Yeomans Brothers Co.

● **OPERATORS should study manufacturers' drawings of equipment installed in their plants to familiarize themselves with the mechanical arrangement of each treatment unit. This sectional elevation shows a typical installation of a clarifier mechanism.**

Operation of Screens. Hand cleaned screens must be cleaned frequently enough to prevent the sewage being backed up by the material caught on the screens. Such backing up may cause deposits in the entering sewer, and may also force undesirable material through the screen thus rendering it less effective. The screen chamber should be hosed and squeegeed weekly, or more frequently in warm weather.

Moving parts of mechanical screens should be lubricated in accordance with the manufacturers recommendations. The screen, buckets, and the screen chamber should be hosed daily to keep them clean and the chamber walls squeegeed at weekly intervals. The entire mechanism should be painted annually. Slack in chains should be taken up in accordance with manufacturers' directions. Spare links should be stocked.

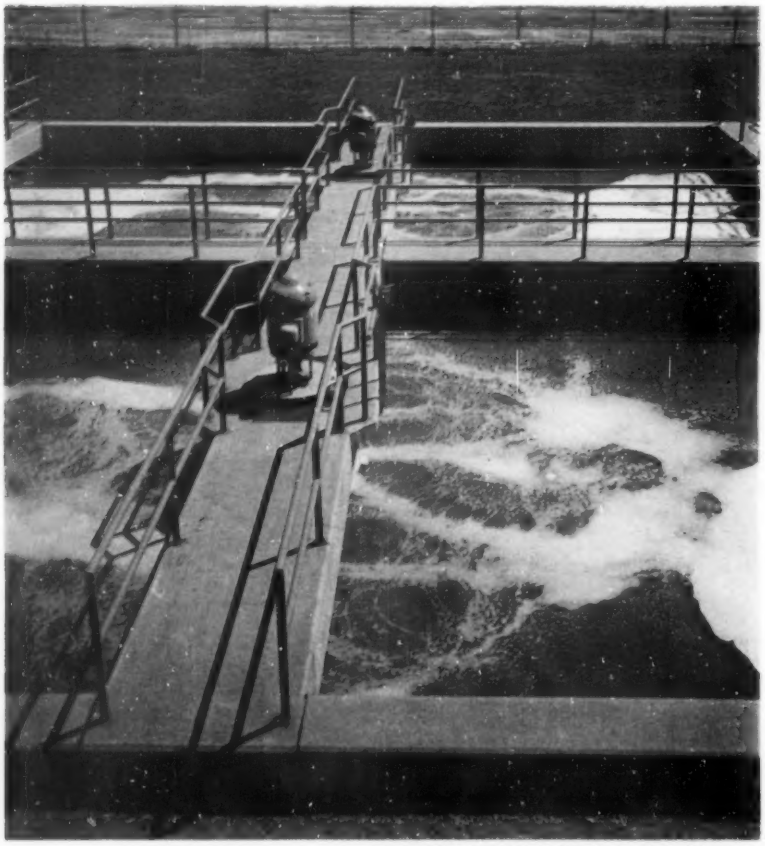
Disposal of Screenings. Screenings are very disagreeable; prompt and sanitary disposal is necessary. Grinding and returning to sewage flow is a good method of disposal; where it is not available, immediate burial should be employed. A trench at least 3 feet deep is necessary, and spraying the screenings with cresote or covering with tar after dumping them into the trench is desirable. Backfill at once and thoroughly with at least 18 inches of compacted cover. At some small plants, screenings may be placed in the digester. A screenings incinerator provides excellent disposal, but small units are not readily available.

Screening Shredders. There are several screening shredders which cut or grind the screenings to small bits and return these to the sewage for final disposal by sedimentation and digestion. These are made by Chain Belt, Jeffrey, American Well Works, Gruendler, Infilco and Chicago Pump. If screenings are to be disposed of by shredding, two methods are in common use. One involves continuous shredding right in the influent channel and the second involves the collection of solids on a screen, with removal from the screen by scrapers and final grinding. These methods transfer the solids removal problem to the settling tanks where the screenings are removed with other sewage solids and pumped to sludge digesters with the sludge collected in the settling tanks.

Comminutors. Screens and screenings disposal problems can be largely eliminated by the use of comminutors installed in the sewer line entering the plant. Comminutors cut the larger floating material into small pieces which pass on into the settling tanks and are removed there by sedimentation. Comminutors are often preceded by grit removal equipment in order

to reduce wear on the teeth. A comminutor can be readily installed in most plants, reducing labor costs and improving operation. Several styles are illustrated in the SEWERAGE MANUAL.

Record of Operation. Records should show the amount of screenings removed daily. This is easiest measured by noting the capacity of the container used and the number of times it is filled. On mechanically cleaned screens, a record should be made of the time between strokes—as 5 minutes or 10 minutes; also of the amount of material removed. When the screen discharges directly into a grinder or when a comminutor is used, there is commonly no record of the amount removed, but measurements may be made at intervals for purposes of record.



Courtesy The Ohio State University, Dept. of Photography

● **ACTIVATED SLUDGE plant at Westerville, Ohio, uses mechanical aerators (American Well Works) to mix air with the raw sewage flow plus 25% return sludge.**

Mechanically Cleaned Sedimentation Tanks

This section covers operation of sedimentation tanks equipped with apparatus for the collection and removal of sludge. It does not refer to septic tanks, to hopper bottom settling tanks, nor to Imhoff tanks, on which a separate section has been prepared.

Purpose of Sedimentation. The purpose of sedimentation is to remove as much as possible of the solids carried by the sewage, specifically those that will float or settle; to separate this material from the sewage; and to treat and dispose of it separately. Such treatment does not produce a "pure" effluent; it does, however, represent a considerable step forward in the process of treatment. From 40 to 60 percent of the suspended solids are ordinarily removed and from 10 to 30 percent of the total solids.

Design of Settling Tanks. Settling tanks are generally circular or rectangular in shape, but some are square. The rectangular, with a length four or five times the width, and the circular are most common. Most tanks are not over 12 feet in depth, since experience has shown these are as effective as deeper tanks. The capacity of the tanks, the width times the length times the water depth, should be equal to the average flow of sewage over 2 or 3-hour period. For instance, a tank 70 ft. long, 10 ft. deep and 15 ft. wide has a capacity of 70 x 10 x 15 = 10,500 cubic feet, or 78,750 gallons. With a detention period of 2.5 hours, such a tank would treat 78,750 x 24/2.5 = 756,000 gallons per day. A circular tank 40 ft. in diameter and 10 ft. deep has a capacity of 40 x 40 x 0.7854 x 10 = 12,566 cu. ft. or 94,250 gallons, and with a detention capacity of 2.5 hours, would treat about 902,000 gallons per day.

To find the capacity of your own rectangular settling tanks in gallons, multiply the length times the width times the average water depth times 7.48; and, in the case of circular tanks, the diameter times the diameter times the depth times 0.7854 times 7.48. All tank dimensions must be in feet and decimals thereof.

Tank surface area is important: primary settling tanks, not followed by secondary treatment, normally are rated at about 600 gallons flow-through per sq. ft. of surface area for 24 hours. Intermediate and secondary settlings tanks are specified at 800 to 1000 gal./24 hrs./sq. ft. Divide the volume of sewage that enters the tank in 24 hrs. by the tank surface area to find the overflow rate.

Operation of Tanks. Sludge is removed continuously in some plants, and two to four times a day in others. Continuous removal reduces floating scum and may result in thicker sludge. The sludge is drawn from the sludge sump in the bottom of the tank by means of pumps, which may operate twice a day at small plants and continuously at large ones, discharging sludge through pumps into the digestion tank. In this type of operation, the operator should take frequent samples of the sludge being drawn; provision is usually made for easy sampling. For continuous operation the pump capacity should be adjusted so that all of the sludge is drawn, but no more. If sewage or very thin sludge is being drawn, the pump should be regulated to draw at a slower rate.

When the collectors are run intermittently, as for one hour twice a day, the pumps should be started after one-half revolution of the scrapers and should be allowed to run as long as they draw good sludge from the tank. Collectors

should be stopped when the sludge becomes thin. A common trouble is excessive pumping of sewage instead of sludge to digesters, resulting in digestion difficulties and too much supernatant.

When the sludge is drawn by hydrostatic pressure, that is by the pressure of the sewage in the tank, the valve on the pipe is opened part way, and the sludge allowed to flow out; when the sludge becomes thin, the valve should be closed. Most plants utilizing this method are so designed that the operator can see the sludge as it is being drawn, and can judge when the valve should be closed.

The frequency with which sludge should be drawn from a settling tank depends upon several factors. It should be drawn before solids become septic and begin to float to the surface; however, solids should not be allowed to accumulate in the hoppers until they become so compact that they are difficult to remove.

Some floating material collects on the top of the tanks. Mechanical apparatus is now commonly provided to remove such material. Where it is not available, hand removal at least once a day is necessary. Appearance is the principal factor for guidance in this. Skimmings are usually placed in the sludge digestion tank. Most plants are so designed that these skimmings may be swept into a trough which discharges into the digester or into a pump sump so that further handling is not necessary.

The side walls of the settling tank sometimes collect fine solids, which in warm weather decompose; also at the water line, some grease is deposited. This should be removed daily with a stiff brush or with a squeegee, and the walls washed down with a hose, care being taken not to disturb the tank contents more than is necessary. Rising gas bubbles indicate improper or inadequate sludge removal or a very strong supernatant.

The inlet channel should be washed out with a hose every day and scrubbed at least once a week, using a stiff broom; the same treatment should be given to the outlet channel and to the baffle.

Manufacturers furnish with their equipment a lubrication chart which shows where to oil and grease and tells what kind of lubricant to use. These instructions should be followed carefully. The motors and reducers are complicated pieces of apparatus, and even though the collector itself travels slowly, this is only because of gear reducers, parts of which travel at a high speed. If the lubrication chart has been lost, write to the manufacturer of the sludge collecting apparatus and ask for a replacement.

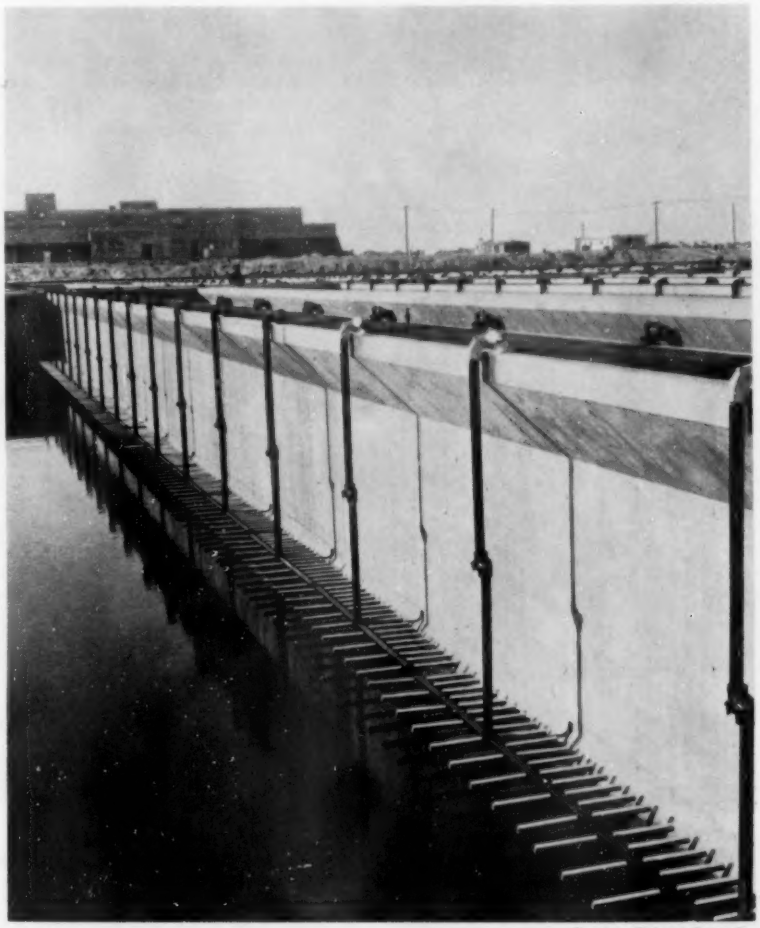
At some plants it is the policy to empty a tank every six months, inspect the machinery and make necessary adjustments. Some of the newer plants are designed so the collector chains come up and out to facilitate inspection.

Efficiency of the settling tanks should be checked by observing the suspended solids and BOD of the influent and effluent at frequent intervals and recording these results. Short circuiting should be checked, and if it is serious, something should be done about providing baffles or correcting the cause.

Records of Operation. For sedimentation tanks of this type, the records of operation should include at least the following: When and for how long the collecting apparatus is run; volume of sludge removed, preferably in cubic feet per million gallons; the solids content of the raw sludge; temperature of the sludge removed; pH of the sludge; settleable solids daily of both the influent and the tank effluent, and average detention.

Operation of Imhoff Tanks

The Imhoff tank acts both as a sedimentation tank and as a sludge digestion tank. It is, in effect, a two-story tank. The upper part is a settling tank; the lower part stores and digests the solids that settle out of the sewage. These pass through a trapped slot in the bottom of the settling compartment and are retained in the sludge compartment until digestion has progressed far enough so that the sludge may be dried on sand beds. There are three important parts of an Imhoff tank —the settling, or flow-thru compart-



Courtesy Chicago Pump Co.

● **IN PRESSURE aeration, the air is forced by means of compressors or blowers through porous diffusers installed near the bottom of a tank. These diffusers at the Los Angeles Hyperion plant can be swung up to walk level for quick inspection.**

ment; the sludge compartment; and the gas or scum vents. A well designed and properly operated Imhoff tank has nearly the same efficiency as a tank equipped with mechanical sludge removal apparatus.

The settling compartment is designed for a retention period of 1.5 to 3 hours, usually about 2 hours, and should provide a surface area of at least 1 sq. ft. for each 600 gal. per day flow. The sludge digestion compartment is usually designed with 3 to 6 cubic feet of capacity for each person it is expected to serve. In the colder parts of the country it should provide for approximately a 6-month digestion period. The scum or gas vents should have an area of from 20 to 30 percent of that of the tank surface.

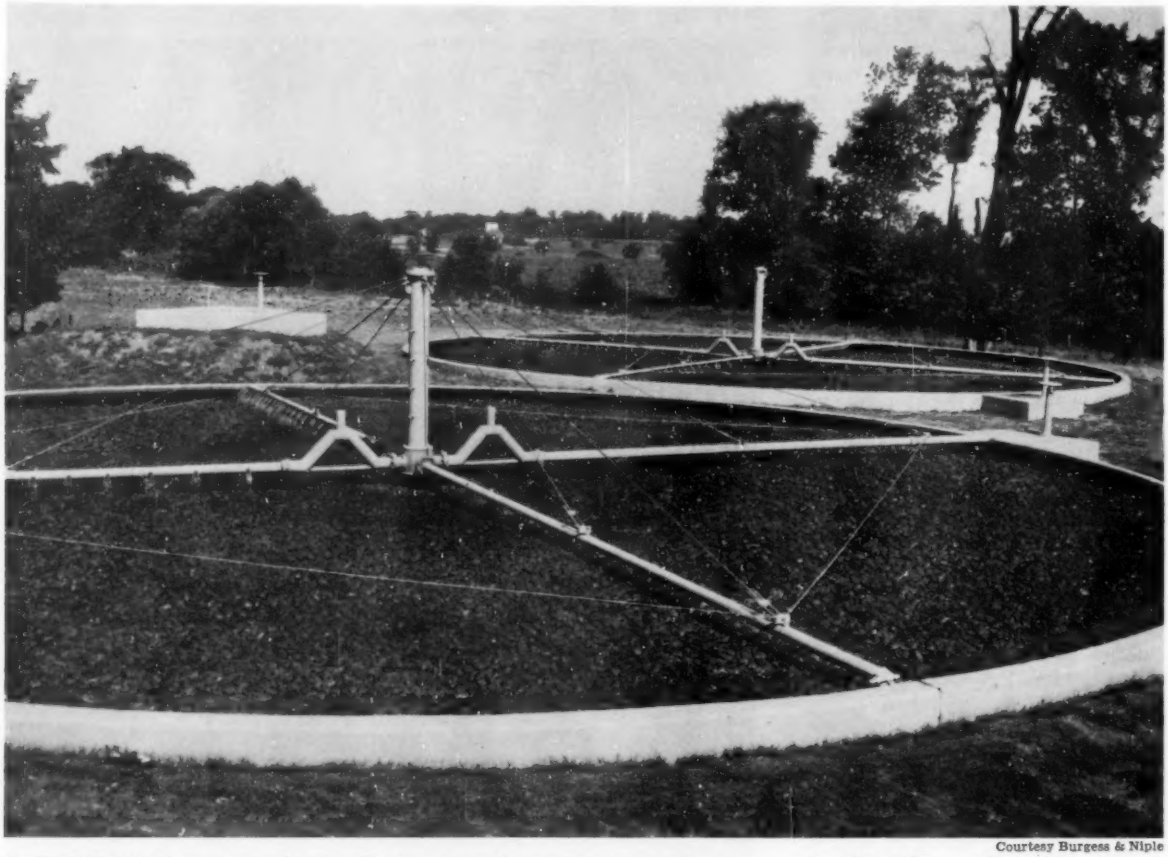
The inlet and outlet channels should be kept clean with a scrubber or squeegee and hose. Some Imhoff tanks are equipped with channels and gates for reversing the flow. Such gates and channels should also be kept clean, and the flow should be reversed about twice a month. The heavier and bulkier solids in sewage settle more quickly. Therefore that part of the tank nearest the inlet receives most of the solids and may fill and require emptying before there has been time for digestion. Reversing the flow aids in getting equal deposits of sludge.

Sedimentation Compartments. Grease and scum should be skimmed off the tank surface daily or more often. Careless skimming may break up the solid matter in the scum and permit it to be carried out in the effluent. The material skimmed off may be placed in the gas vents, or burned or buried. The sides, ends and sloping bottoms of the sedimentation compartment should be squeegeed frequently, every day or every other day in warm weather, and weekly or twice a week at other times. The material that clings to the walls should be pushed down through the slot. The slot should also be kept clean. A chain drag is sometimes used for this purpose. The slot should be cleaned two or three times a week.

In cleaning the walls and slot, unnecessary turbulence or stirring should be avoided. Material in the sludge compartment should not be brought up into the settling compartment. The Imhoff tank is designed to keep the decomposing material in the lower chamber out of contact with the sewage in the settling chamber.

Gas Vents and Scum Compartments. Floating solids from the digestion chamber rise into these openings; also gas produced by the digestion of the sludge escapes through them. The scum may become very heavy and should be broken up from time to time to permit the escape of gas and prevent the formation of solid masses of dry or partly dry material.

This breaking up of heavy material in the gas vents can be done with a rake or hoe; by using a fairly large hose under considerable pressure; or by pumping sewage preferably from the upper part of the digestion compartment with a small force pump. This is returned through the gas vents and does not tend to cause flow between the upper and lower compartments. For the same reason, too much water should not be used. The scum, if quite dry, may



Courtesy Burgess & Niple

● **TRICKLING filters at the Orrville, O., treatment plant are essential elements treating 0.8 MGD to 99% BOD removal. Filters are 68 ft. diameter and 5 ft. deep. Organic loading is 2150 lbs. of BOD per acre-foot; hydraulic loading is 6 MGAD.**

be removed with shovels and placed on the sludge drying bed for complete drying out.

The addition of lime aids in maintaining an alkaline reaction, which is desirable for proper sludge digestion. It may be added as a solution and well mixed, or washed in with a hose.

In cold weather, when the scum tends to freeze, holes may be punched through it to allow the gas to escape.

The Sludge Compartment. The sludge digestion compartment is inaccessible, as well as out of sight. Therefore operation must be based on pH readings, on the appearance of the sludge and on soundings to determine the depth of the sludge deposit.

The pH of the sludge should generally be 7.2 to 7.6. An acid sludge may result in foaming. Well digested sludge is usually dark, rather granular and without disagreeable odor.

The depth of sludge may be determined by: (1) A pitcher pump with a weighted suction hose marked at 1 or 2-ft. intervals. Lower the hose through the gas vent or slot, working the pump handle. When thick sludge comes through the pump, or the pump chokes, as it usually will with thick sludge, the depth is determined; (2) A weighted wooden block, or iron plate 12 in. square. This is lowered into the tank and reduction in weight on the graduated chain or wire indicates depth. This method is generally not very satisfactory. (3) A metal can or bottle, with a stopper and spring fastened to a rod. The stopper is pulled out with a wire and the bottle contents are examined.

Drawing Sludge. Sludge should be drawn whenever it approaches within 18 in. of the bottom of the slot in the sedimentation chamber. Sludge should be removed at a slow and regular rate; at comparatively frequent intervals; and usually not more than one-half of the depth of sludge should be removed at once.

Sludge in an Imhoff tank tends to become quite solid and firm, especially where there is silt or sand in the sewage. If the sludge is drawn at a rapid rate, a hole may be formed that will draw undigested sludge or even sewage, while some of the digested sludge remains in the hopper.

Drawing of sludge is best accomplished by opening the draw-off valve part way, meantime pushing the sludge toward the bottom of the hopper with a long rod having a cross piece attached. A hose may be let down through the sludge pipe and water forced through to loosen the sludge. Care should be taken to have a vacuum breaker on all water connections to a sewage plant; otherwise a hose so used and left immersed would constitute a dangerous cross-connection to the water supply. In summer, sludge normally will be drawn about once a month; in the winter only when necessary. After the sludge is drawn, the sludge piping should be flushed out with water or supernatant; and, where freezing is no hazard, the pipes should be left full of water to prevent sludge hardening in and clogging the pipes. It is often advisable to draw down the sludge in the late summer and fall to provide storage space for the winter.

Foaming. Gas vent contents sometimes become light and foamy and "boil over," a condition called "foaming." It may be caused by industrial wastes from milk plants, canneries, breweries, etc.; or it may be caused by drawing too much sludge, by overloading the sludge chamber, by rapid increases in temperature of the sludge; or by a combination of these.

Foaming of Imhoff tanks often occurs in the spring when there is an increased activity in the sludge digestion compartment with the advent of warm weather. More gas is produced and the chambers will sometimes boil over to create a really serious problem at the plant.

If the cause can be determined it should be removed. If diagnosis of the trouble is not possible, various remedies may be tried, including: Putting the tank out of service temporarily, if another is available; drawing a small amount of sludge; adding lime through the gas vents; breaking up the foamy scum; and prechlorination of the sewage, using three to ten mg/l of chlorine.

Operation Records. The following records of Imhoff tank operation are desirable: 1. Settleable solids in raw sewage and in Imhoff tank effluent, daily, by means of Imhoff cones; 2. record of skimming sedimentation compartment; 3. record of cleaning slots; 4. record of breaking up scum; 5. pH of sludge—daily or weekly record; 6. amounts of sludge drawn and dates of drawing; 7. moisture and volatile contents of sludge; and 8. record of sludge depths.

Activated Sludge Plants

There are two general types of activated sludge plants—diffused air and mechanical aeration. General features of operation are similar. The sewage is first settled in sedimentation tanks and the partly clarified effluent then flows into aeration tanks. As the sewage enters the aeration tanks, activated sludge from the final settling tanks is added to it. Passage through the aeration tanks requires 5 to 8 hours, during which time the mixture of settled sewage and return activated sludge, the mixed liquor, is continually aerated. The aerator tank effluent is then discharged to the final settling tanks. A considerable portion of the sludge collected in the final settling tanks is returned to the inlet of the aeration tank; the remainder, the waste activated sludge, must be disposed of by digestion or other means.

Air for agitation and aeration is supplied, in the case of diffused air plants, by means of compressors or blowers which force air through specially constructed diffusers in or near the bottoms of the tanks; and a similar action is obtained in mechanical plants by mechanical aerators. Agitation is necessary to keep the mixture of sludge and sewage in motion, so that the particles will not settle and so that the activated sludge particles have intimate contact with sewage. Air, either diffused as very small bubbles, or obtained from the atmosphere by mechanical aeration, is necessary to maintain essential aerobic conditions in the plant.

Operation of Sedimentation and Aeration Units. Heavy loads of strong sewage; strong supernatant from the digester; or large and rapid increases in flow of sewage must be cared for by providing an adequate return volume of active sludge. Where possible, digester supernatant liquor that contains 3,000 mg/l or more of suspended matter should be disposed of otherwise, or pretreated, before discharge into the settling tank.

Frequent tests for dissolved oxygen should be made on the plant effluent and in the aeration tanks. The pressure of more than 4 or 5 mg/l of DO indicate over-aeration or an improper distribution of air. More air should be supplied at the inlet end of the aeration tank. Plants are usually designed to apply one-half of the air in the first 25 percent of the tank length. This tapered application of air is desirable for economy and effectiveness of operation.

The control of solids in the aeration tank liquor is important. Since each activated sludge plant is a law

largely unto itself, each operator must determine from his own personal experience at his plant the amount of solids that gives the best and most economical results. If the solids content is too great, the air supply may be deficient and inferior treatment may result. If there is a deficiency of solids, that is, not enough to produce the necessary concentration of activated sludge in the aeration tank, inadequate treatment will result. Under usual conditions at most plants, 2,000 to 3,000 mg/l of solids are carried in the aeration-tank liquor of diffused-air plants, and 300 to 900 mg/l in mechanical aeration plants. As previously stated, this factor must be varied with the strength of the sewage.

Return activated sludge must be added to the incoming sewage as it enters the aeration tank, on the basis of volume of flow as well as strength of sewage. Sludge must be stored in the final settling tank to meet these needs, but since the stored sludge deteriorates rapidly, good management is necessary, as well as a knowledge of local conditions of flow, strength, etc.

Bulking. The sludge volume index test in diffused air plants will normally give values between 50 and 150, and in mechanical-aeration plants between 200 and 300. The sludge volume index is the volume, in ml, of settled activated sludge which contains 1 gram of dry suspended matter. The sample of mixed liquor is settled 30 minutes for the test. An exceptionally large value for the sludge index generally indicates that bulking is taking place in the final settling tanks. When bulking occurs, the sludge particles are large and fluffy and may tend to rise instead of settling. Bulking also may be caused by the growth of a thread-like fungus which brings about an unbalanced condition in the microscopic life existing in the aeration tank. Industrial wastes may deplete the available oxygen and tend to cause the unbalanced condition just mentioned. The cause of bulking should first be determined. If industrial wastes are the cause, steps should be taken for their treatment at the industrial plant site or for such other action as is necessary. Increased aeration may effectively control the fungus growth and bring the return of normal conditions. Chlorination of the return sludge, or the addition of lime have been helpful. Chlorine dosages up to 6.0 or 7.0 mg/l have been successful, but a smaller application should be used initially.

The activated sludge process is more effective in removing BOD in the summer than in the winter months. A marked drop in temperature may reduce considerably the effectiveness of an activated sludge plant.

Operating Records. In addition to the general records already discussed, records on activated sludge plant operation should include: The percent or amount of return sludge; the suspended solids content; the sludge volume index; DO and nitrates in the plant effluent; and a record of the results of each plant unit as indicated by BOD and solids determinations.

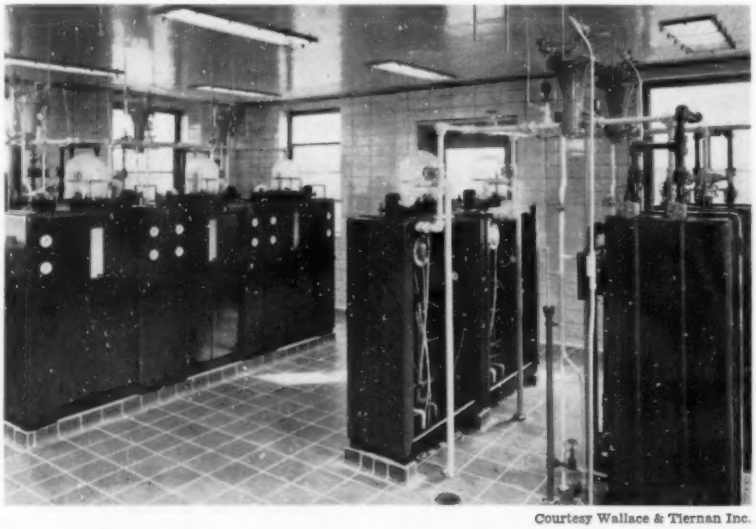
Trickling Filter Operation

A trickling filter consists of a bed of broken stone, 3 to 9 feet in depth. The sewage is applied to the surface of the bed, trickles down through the stone and is collected by underdrains at the bottom. The filter is usually built with a concrete floor and with concrete walls to retain the broken stone. Application of the sewage is now almost exclusively by rotary distributors. The rate of application for standard filters is usually 300,000 to 500,000 gallons per day per acre per foot of depth, based on average flow; but high capacity filters operate at very much higher hydraulic rates—from 10 million to 25 million gallons per acre per day. Most of these utilize recirculation of the filter effluent.

Only settled sewage, that is sewage that has been passed through a settling tank, should be applied to trickling filters. The stone particles are, of course, too large to strain out the suspended matter in the sewage. Purification is effected by the organic film or slime which forms on the surface of the stone. The sewage trickles in thin sheets over the organic film which oxidizes and stabilizes the organic matter in the sewage. There is a considerable reduction in bacteria and in BOD. However, the effluent from a trickling filter should be settled and, like any other sewage effluent, requires careful disposal.

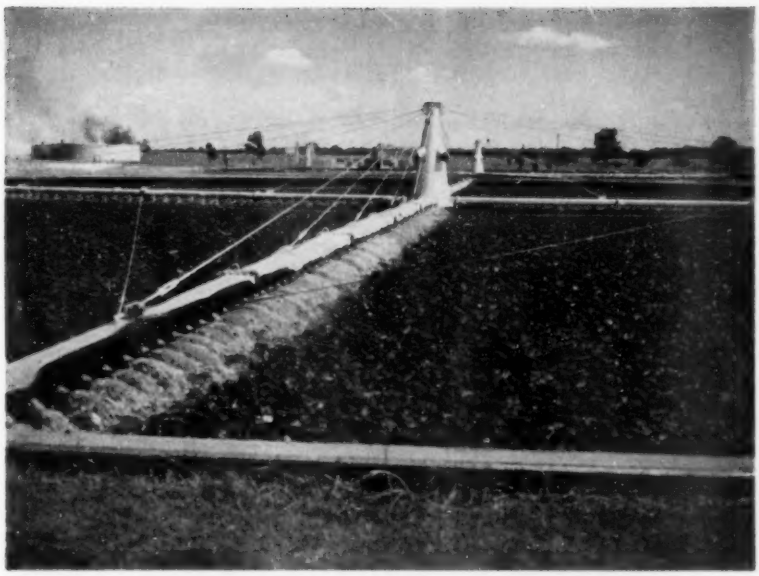
Care of Nozzles and Orifices. Clogged spray nozzles or orifices in revolving distributors should be cleaned as soon as clogging is noticed. To reduce trouble a fine screen may be placed in the discharge channel of the sedimentation tank or the inlet to the dosing tank.

The Dosing Tank. The dosing tank takes the flow from the settling tank, holds it temporarily, and then discharges it at a controlled rate through a siphon, to the nozzles or orifices onto the bed. The interior of the dosing tank used for fixed spray nozzles has one or more sloping sides to insure that all portions of the area around each spray nozzle receives an equal dosage of sewage. Thus, when the dosing tank is full and begins to discharge, there is a greater head and the nozzles spray over a wider area, but as the head becomes less in the dosing tank, the nozzles spray a less area. The tank is made smaller at the bottom so that the smaller areas sprayed with the lesser heads will receive the same dosage per sq. ft.



Courtesy Wallace & Tiernan Inc.

● **CHLORINATION is an essential step in most sewage treatment plants. Depending on the sewage characteristics, heavy dosage may be needed. These five chlorinators in a large eastern plant have a capacity of 6,000 pounds of chlorine each per day.**



● **TRICKLING filters at the Dallas, Texas, plant have produced remarkable results, even with heavy organic loading. This view shows a 176-foot diameter unit.**

A siphon controls the flow from the dosing tank. When the tank becomes empty, the siphon cuts off the flow to the nozzles, permitting the tank to fill again and repeat the cycle. Operation is controlled by air compressed under the bell of the siphon by the rising sewage in the dosing tank.

Perhaps the most common difficulties in the operation of dosing tanks are air leaks in the control piping. This may result in the siphon discharging before the tank is filled, causing a variety of troubles. Occasional cleaning of siphon air and water lines is desirable. Air leaks are difficult to locate, and in cases of continued trouble from this source, it may be cheaper to replace all air piping with new lines. Grease and other solids accumulate in dosing tanks and may cling to the sides, especially at the high water line. Regular removal may prevent clogging the nozzles.

Pooling or Ponding. Pools or ponds sometimes form on the surface of the filter. This is due to organic growths or to carelessness in dumping fine materials in one place when building the filter. When this is the cause, the fine material must be removed and replaced with suitable stone.

When the trouble is from organic growths forking or raking the stone to a depth of 8 to 12 inches may be effective. Other methods include washing the surface of the bed with a heavy stream from a fire hose; taking the bed out of service for 24 to 48 hours, if this can be done without serious detriment to the quality of the effluent; flooding the bed for about the same period, if the bed is so constructed that it can be flooded; or by applying rather heavy dosage of chlorine to the sewage before it reaches the bed.

Application of 3 to 5 mg/l of chlorine has been found helpful; in some cases, dosages up to 10 mg/l have been used. Caustic soda has also given good results with a dosage of about 10 mg/l. When using chemicals, as chlorine, treatment may be given for 8-hour periods on alternate days.

Filter Fly Control

Filter Flies. The filter fly, *Psychoda alternata* may be present in such numbers as to be a nuisance at the plant and at houses within a quarter or half mile of the plant. The flies lay their eggs in the filter film; the incubation or development period depends on the temperature, but is about 9 days. The larvae can be drowned by flooding the filter for a 24-hour period at intervals of 9 or 10 days. Chlorination, as directed in the preceding paragraphs, using 3 to 5 mg/l of chlorine is reported to be effective, if application is made every 7 to 10 days.

DDT and other insecticides have been used for control of filter flies. Often a strain or breed of flies develops that is resistant to the particular chemical being used, so that a change is desirable. In addition to DDT, chlordane or benzene-hexachloride may be used. In computing applications, 1 mg/l based on the daily flow of sewage is normal practice, but this is applied during a short period, usually 2 hours or so, using an equivalent rate, as 12 mg/l for 2-hour application. The chemical may be added to the dosing tank or other suitable spot. The 1 mg/l dose is based on the amount of active chemical and no allowance is made for the carrying vehicle. None of the above chemicals appear to affect filter efficiency when used in the amounts recommended.

Adult flies can be killed by using any of the commercial fly or insect sprays, or by burning with a blow torch, but these methods are possible only after the nuisance has been produced. Prevention is far better.

In most plants using spray nozzles each line of distribution piping is provided with a plug or valve so that the line can be flushed. Where such provision has not been made, the spray nozzle at the end of each line can be removed during a dosing period. This will usually give sufficient velocity through the line to flush it properly.

High-Capacity Filters. The general directions outlined above apply also to high-capacity filters of the Biofilter, Aerofilter or Accelo-Filter types. In the Biofilter, a portion of the effluent from the filter is recirculated to the primary settling tank and, by dilution, lowers the BOD of the raw sewage. The application to the filter surface is at a much higher rate and the BOD load applied may be 2,400 to 3,200 pounds per day per acre foot. Uniformity of operation procedure and maintenance of adequate recirculation, which may be varied in some plants in accordance with flow and strength of sewage, seem to be important.

The Aerofilter applies the sewage in a fine spray. Recirculation is utilized only at low flow periods. The Accelo-Filter utilizes recirculation to the distributor, with a BOD loading about the same as the others and an application rate of 10 to 13 mgad.

Odors and Prevention. If the sewage is septic, spraying it into the air liberates the contained hydrogen sulfide gas, causing odor. This occurs also, but not to the same extent, with the rotary type distributor. Odors must be controlled by eliminating the causes before the sewage reaches the nozzles. Prechlorination is probably most effective and economical.

Records of Operation. The operating record should show the units of

the filter in service each day; the number of nozzles cleaned, the dates of cleaning the distributor mains and the underdrains, and similar detail data; the rate at which the filters were operated; and, where used, the amount of recirculation.

Methods of treatment and dates of measures taken for correction of ponding and for *Psychoda* control and for other unusual occurrences should be recorded in plant operation data.

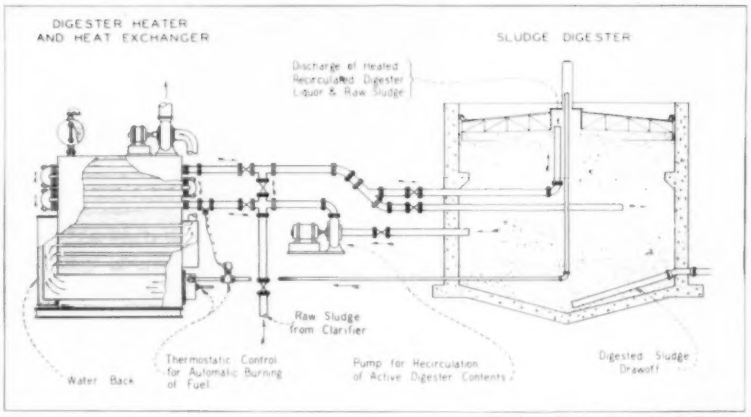
Secondary Settling. From time to time, but most generally in the spring and fall, standard rate trickling filters "unload." High-capacity filters unload continuously. The materials accumulated in the interstices of the bed slough off and are washed out by the sewage. It is customary to provide a secondary settling tank for the effluent from trickling filters. The usual period of detention is 1 to 1½ hours for standard-rate and 2 hours for high-capacity filters. Operation of this secondary settling tank does not differ materially from the operation of primary settling tanks except that they produce less scum and are not usually provided with scum removal mechanisms. When figuring the efficiency of filters, the filter and the following settling tank are usually considered a unit.

Disinfection of Sewage

Chlorination of sewage is employed for a number of purposes: 1.) To reduce the bacterial content of the plant effluent and thereby make it less of a nuisance and danger to bathing beaches, shellfish beds, etc.; 2.) to control or prevent odors; 3.) to aid in coagulation when ferrous sulphate or copperas is used as a coagulant; 4.) to reduce the BOD of the sewage; 5.) to aid in sludge thickening in activated sludge plants; 6.) to provide a means for removing grease when used in conjunction with air; 7.) to help control sludge digester foaming; and 8.) to aid in the control of sludge bulking in aeration tanks.

Whenever an operator is having any one of the operational difficulties suggested as being remedied by the proper use of chlorination he should investigate how best to use chlorine to improve his plant efficiency.

Bacterial Reduction. While it is not possible to kill all the bacteria in sewage by chlorination, the number can be greatly reduced. This does not make water into which chlorinated sewage has been discharged safe to drink, but it does lighten the load on subsequent water purification processes. For raw or untreated sewage, 10 to 12 mg/l; and for the effluent from a trickling or sand filter, about 5 or 6 mg/l may be applied.


DIGESTER HEATER AND HEAT EXCHANGER
SLUDGE DIGESTER
Discharge of Heated Recirculated Digester Liquor & Raw Sludge
Raw Sludge from Clarifier
Thermostatic Control for Automatic Burning of Fuel
Pump for Recirculation of Active Digester Contents
Digested Sludge Drawoff
Water Back

Courtesy Pacific Flush Tank Company

● **GOOD DIGESTER operation is important in every sewage treatment system. This includes proper handling of heating, recirculation and supernatant drawoff. The diagram above shows a typical arrangement of an external system for digester heating.**

The required amount of chlorine is best determined by the orthotolidine test. After 15 minutes contact of chlorine with sewage it is sampled for a residual. A few tenths mg/l residual should be maintained.

Strength of sewage varies considerably throughout the day, being strongest, as a rule, after the middle of the forenoon. Dosages of chlorine should be adjusted for this period; a further adjustment can be made for the reduced and weaker night flows in many cases. Automatic controls are available.

Odor Control. As sewage decomposes, odors occur. The most common and important agent causing odors is hydrogen sulfide. Chlorine is used both to prevent its formation and to react with it after it has been formed. Control is more effective, as much less chlorine is required for prevention than for neutralization.

The most common method of prevention is to apply the chlorine in the main sewer as far as possible above the treatment plant. Chlorinated benzols also have proven effective in odor control in sewers. Chlorine acts on those organisms in the sewage which decomposes the sulfur compounds, and prevents the formation of the hydrogen sulfide. From 3 to 30 mg/l of chlorine may be required; generally 8 to 10 mg/l will effect a marked reduction in odors. In some places odors are noticeable only during the evening. Under such conditions, chlorination may be needed for only a portion of the day.

After the hydrogen sulfide is released, chlorine will combine with it to reduce or prevent odors, but the amount of chlorine required is considerable, and such procedure is rarely economical.

Forms of Chlorine. Chlorine is employed primarily in the form of liquid chlorine, Cl_2; and also in the smaller plants, as calcium hypochlorite. Liquid chlorine is 100 percent available chlorine. Actually it is a gas, but under pressure it becomes a liquid in which form it is shipped in steel cylinders. The pressure varies with the temperature from 40 to about 150 pounds per square inch, being greatest at high temperatures. At 70°F it is about 85 pounds per sq. in. The cylinders used in small plants contain 100 or 150 pounds of chlorine, but one-ton and railroad tank-car containers are available.

Applying Liquid Chlorine. Liquid chlorine is applied by means of a gas chlorinator, the function of which is to take the liquid chlorine from the cylinder, measure it, and feed it into the sewage at the desired rate. Application may be in either of two ways: As a gas, or mixed with water to form a solution, which is then added to the sewage. The solution feed method is used almost exclusively in sewage treatment. A supply of water under some pressure must be available.

Operation of a Chlorinator. For proper operation, the room in which the chlorinator is kept should be over 50°F. Warm gas entering a colder chlorinator will condense and may cause clogging. Therefore, the chlorinator should not be placed on an outside wall, but should be in a warmer place than the cylinder

or the pipe connecting the cylinder and the chlorinator. A radiator, a small stove, or an electric heater may be used. The chlorinator building should be insulated or well protected. When cold is not too intense, an electric light left burning may furnish the required heat.

Chlorine cylinders should be kept on scales and the weight read each day as a check against the amount of chlorine used; or in the case of very small plants, the scales may be read weekly.

The maximum drawoff or discharge from 100 and 150 pound cylinders at 70°F is approximately 35 pounds per 24 hours. Due to the change from a liquid to a gas, an excessive drop in temperature will occur; and if more than 35 pounds are used daily 2 or more cylinders should be attached or larger containers used.

A reserve supply of chlorine should be kept on hand; also a supply of duplicate parts, including valves, gaskets, etc. But the operator should not attempt major repairs. Whenever possible an entire duplicate chlorinator should be kept for possible emergencies. Ask the manufacturer of your chlorinator for full directions for starting and stopping, and for other details regarding it.

Chlorine leaks are, of course, dangerous since the gas is an irritant to the lungs and causes violent coughing. Its odor is detectable at a concentration of 3.5 mg/l in air; 4 mg/l is the maximum concentration that can be breathed for one hour without bad effects; 15 mg/l causes throat irritation; 30 mg/l causes coughing; 40 to 60 mg/l is dangerous when inhaled for 30 minutes or more; and 1,000 mg/l, one-tenth of one percent, may produce death after 5 minutes exposure.

Leaks can be located by means of an open bottle of ammonia. Valves, connections and other places that may permit chlorine to escape are tested with the ammonia bottle. White fumes of ammonium chloride are formed when chlorine combines with ammonia. Special gas masks are desirable for use in case of leaks. Chlorine being 2.49 times as heavy as air, requires ventilation at or near the floor level.

Metal parts on the chlorinator, or other metal surfaces, may become corroded. To prevent this, these may be painted with a thin coating of gasoline and vaseline. The gasoline evaporates and leaves a light coat of vaseline which is sufficient protection.

Computing Dosages. When using liquid chlorine, the desired dosage in milligrams per liter times the number of million gallons per day times 8.33 is the number of pounds of chlorine to be fed daily. For instance, to treat 2 mgd with 6 mg/l of chlorine, 6 x 2 x 8.33 = 100 pounds per day.

If it is desired to vary the amount of chlorine hourly, the number of millions of gallons per *hour* times the dosage in mg/l times 8.33 indicates the number of pounds per hour. For example, with a dosage of 8 mg/l and a flow of 300,000 gallons per hour, there will be required per hour, 8 x 0.3 x 8.33 = 20 pounds.

Most chlorinator scales read in pounds per 24 hours. For the proper setting, multiply the hourly rate by 24. In the above case, the rate in pounds per 24 hours would be 20 x 24 = 480 pounds.

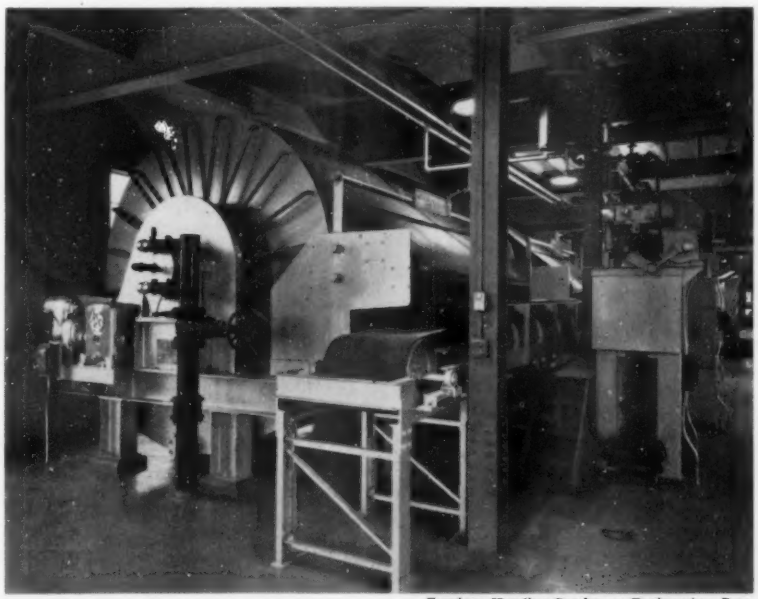
Records of Operation. The records covering the application of chlorine should show (1) the volume of sewage chlorinated daily; (2) the rate of application of the chlorine; (3) the residual chlorine present taken at the same hour every day; (4) the weight each day, at the same hour, of the chlorine tanks; and (5) new cylinders placed on the scales and their weight.

Sludge Digestion Tanks

The disposal of sludge that is deposited in the bottom of sedimentation tanks is one of the difficult problems in the operation of a sewage treatment plant. This material is highly decomposable and offensive. Generally the best method of treatment is by anaerobic digestion. In this, the sludge is stored in deep tanks for 30 to 50 days or longer, during which time the organic matter is digested and converted into more stable forms. After this digestion process, the sludge can be filtered or dried on sand beds without nuisance.

Moisture Content. The solid materials in raw sludge, as drawn from settling tanks, does not ordinarily exceed 4 or 5 percent by weight, the remainder being water; and in very thin sludge, there may be even less than 1 or 2 percent of solids. Where the solids content is only 1 percent, there are 99 parts of water for each one part of solid material; where it is 2 percent, there are 49 parts of water for each; and where it is 4 percent there are 24 parts of water. Thus a sludge with 1 percent of solids is, for the same amount of solids, about four times as great in volume as a sludge that has 4 percent of solids.

Amount of Sludge. The moisture content has such a bearing on the volume of sludge that it is impossible to make a statement as to the volume of sludge to be expected. The only basis on which to make a comparison is that of the amount of dry solids, which is secured by evaporating the sludge to a dry condition. The usual sewage treatment plant will remove from 100 to 300



Courtesy Komline-Sanderson Engineering Corp.

● **SLUDGE DEWATERING and disposal are often costly jobs. Work can be lessened and costs reduced with modern vacuum filters, such as these installed at York, Pa.**

pounds of dry solids per 1,000 population or 0.1 to 0.2 pound per person per day. The actual amount of sludge varies from 2,500 to 10,000 or more gallons per million gallons of sewage.

Sludge digests rapidly at a temperature of 80° to 95°F. Sewage is much cooler than this — usually varying, during the year, from 45° to 70°F depending upon geographical location. Therefore in most plants it is desirable and economical to heat the sludge, since digestion is more rapid and a smaller tank can be used—2 to 3 cu. ft. per person is probably enough for a heated tank in a primary treatment plant, but at least 5 cu. ft. per person is necessary for an unheated one, except in warm climates. In both cases, more space will be required if secondary treatment is provided. Heating is usually accomplished by means of hot water pipes placed inside of the tank, or by special outside heat exchangers, burning the gas that is formed during the digestion of the sludge. This gas, which is about 65 percent methane has a heat value of around 650 BTU per cubic foot or about the same as ordinary cooking gas. About 1 cu. ft. per person per day is produced on the average.

Operation Details. Sludge should be added to the digester on a regular schedule and in as small increments as possible, since a heavy load of fresh solids may interfere with digestion. Sludge should be completely removed from the settling tanks but sewage should not be drawn. It is not generally possible to store or hold sludge in the settling tanks; the digestion tanks must be capable of taking all the sludge that is produced every day without being overloaded.

Where digesters are equipped with mixers these should be operated in accordance with the manufacturer's instructions. Where there are facilities for recirculating by pumping, some operators prefer to use these facilities for promoting digestion, breaking down scum, mixing lime with the sludge for pH value adjustment, etc. Where no facilities for mixing or recirculating sludge are provided, the operator must rely upon natural mixing of the raw and digested sludge in the digestion unit.

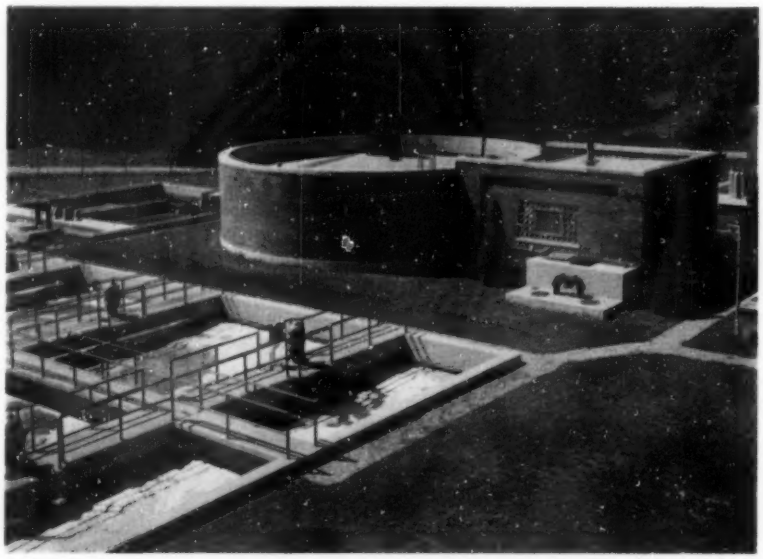
For digesters with pipe heating coils the hot water pumped through the coils of the tank is generally maintained at a temperature of 120°F to 130°F. A temperature much above 140°F may bake the sludge on the outside of the pipes and cause loss of heat conductivity. The contents of the tank are usually kept at 80°F to 95°F. Thermometers record the temperature of the digesting sludge.

Sludge is removed when it is fully digested. Most digesters are provided with devices for sampling the sludge, so that only fully-digested sludge need ordinarily be drawn. Too much sludge should not be removed at one time. To do this may rob the tank of the "ripe" sludge and leave an insufficient amount to mix with the fresh sludge added every day. Ordinarily when sludge is drawn, the sludge drying bed unit is filled to capacity. This is necessary because the number of drying beds available is usually limited and each must be worked to capacity. When drawing the sludge, the operator should watch the sludge, and cease drawing it whenever any change in appearance is noted that indicates improperly digested sludge. A glass elbow or pipe section is handy. Generally not over 10 percent of the capacity of the digester should be drawn at one time.

Sludge digesters have two functions, (1) to reduce the organic or volatile content of the solids, and (2) to concentrate the solids into a sludge with less moisture content. These two objectives are difficult to accomplish in one digester as the first objective requires stirring or mixing and the evolution of large amounts of gas thus keeping the digester contents well mixed. The second objective can be accomplished best in a quiescent tank where there is an opportunity for the sludge solids to concentrate in the bottom of the digester. This has led designing engineers to specify stage digestion which allows the first objective to be accomplished in the first tank and the concentration of solids and development of a good supernatant to take place in the second stage tank.

Frequent pH tests of the sludge should be made. Electrical pH apparatus is recommended. Sludge digestion proceeds most favorably at pH values of 7.0 to 7.6—preferably above 7.2, but some plants report good results with readings as low as 6.8. The alkalinity of the supernatant or the sludge, which may run from 1,500 to 3,500 mg/l also affords an excellent check on operation.

If the pH value is below 7.0, it may be desirable to try to raise it. This is most frequently done by adding lime to the sludge as it enters the digester. It is almost impossible to determine, except on the basis of past experience, how much lime should be added. The alkalinity of the supernatant is a help on this. A start might be made using 0.25 to 0.50 pound per cubic foot of sludge, with more added if the pH value or alkalinity does not rise appreciably in a few days. The lime can be added at the sludge pump, or in the recirculation pump if there is one, as recirculation is helpful in mixing.



Courtesy The Ohio State University, Dept. of Photography

● **SLUDGE digester with floating cover at Westerville, Ohio. This plus a converted Imhoff tank provides 4.15 cubic feet per capita. Ample sludge storage capacity in modern heated tanks helps improve the operation of many other plant units.**

In many plants, the first year of operation of a digestion tank is a troublesome one. The operator should secure detailed directions from the designing engineer or the manufacturer of the equipment installed in the digester, and should follow these instructions, calling for further help as needed.

A sludge digester may be started in operation, at a plant where no well digested sludge is available, by pumping it full of sewage first. It is then heated to a temperature between 80 and 90°F and small increments perhaps 10 percent of the sludge produced by the plant are pumped daily to the heated digester, the rest being wasted to a lagoon or to a diluting body of water. Observations of gas production will indicate to the operator when the quantity of sludge added to the digester may be increased. At the end of approximately 60 days, the digester should be capable of accepting all the solids being produced by the plant and still maintain suitable pH and gas production.

Operating Difficulties. Foaming may be due to the presence of acid sludge; to the addition of too much raw sludge at one time; to the presence of industrial wastes; and to too rapid digestion, which may occur in unheated tanks with the advent of hot weather. If possible to dispose of the sludge otherwise, do not add raw sludge for several days, and then only in small amounts. If the sludge is acid, try to bring it above the neutral point by adding lime or other material. Draw some sludge to reduce the level in the tank, but not too much. If the trouble appears to be due to industrial wastes, try to correct these by pretreatment.

The fats and oils that normally occur in sewage as scum and which are usually pumped to the digester will be acted upon by the normal sludge digestion microorganisms, especially if these materials are kept submerged. Submergence is accomplished by providing some means of breaking the scum layer.

In areas where the water contains considerable mineral matter in the form of sulfates, decomposition of these may take place in the digester with the production of hydrogen sulfide. If the tank is a closed one, and the gas is burned, there will be no odor; but the resulting acid may corrode meters, flame traps and perhaps piping. This is prevented by neutralizing the H_2S by passing the gas through iron oxide or other scrubbers; or by maintaining the gas at a temperature high enough to eliminate moisture in it, thus preventing the formation of the acid which is the corroding agent. It is well to consult with the manufacturer of the digester equipment.

Utilizing the Gas. The gas from digesters is commonly used for heating the sludge in the digester; in the plant laboratory; for heating the plant buildings; and for operating gas engines to drive pumps when pumping is needed. This gas is explosive and equipment for handling it and utilizing it should be furnished and installed only by a manufacturer specializing in this work, and not by plumbers; nor should it be homemade.

It takes about 100 lbs. of organic solids decomposition to produce 1000 cu. ft. of sludge digester gas.

Supernatant Liquor. The overflow from the digestion tank, or supernatant, frequently offers a problem in disposal, since both its solids content and its BOD are very high. It is rather common practice to run or pump this back into the inlet of the sedimentation tank. In some plants this method of disposal is satisfactory; in others it appears to affect adversely the quality of the effluent. The strength of the supernatant, the capacity of the digester and the characteristics of the sewage are factors.

The supernatant amounts, in volume, roughly to the sludge pumped from the settling tank less that drawn onto the drying beds. There is no established satisfactory method of supernatant disposal. If it appears to interfere with proper operation of the settling tank, treatment on sand beds may be tried with the advice of your state sanitary engineer. If the supernatant appears to be of unusually bad quality, ask for advice from the engineer or the manufacturer of the digester apparatus, as the difficulty may lie in faulty operation of the digester or in lack of capacity which is perhaps the most usual cause.

Operating Records. If sludge is pumped from the settling tanks to the digestion tanks, a record of the hours of pumping and of the pump capacity should be kept; it is very desirable to know how much sludge, in gallons or cubic feet, is added to the digester daily. Pump capacities should be checked at regular intervals. Flow meters on the sludge lines are better for recording volume of flow. The temperature of the sludge in the digesters should be recorded daily or weekly; also the pH value of the sludge. The dates on which sludge is drawn should be recorded, with the amount of sludge drawn. Frequent tests should be run to determine the percent of dry solids in the sludge as removed from the digester. Other desirable information includes total solids and volatile solids in the digested sludge and the BOD of the supernatant. Volume of supernatant returned to the treatment process should be recorded daily. A record of the daily gas production from the digester should be made from the gas meter; also of water temperatures in the heating water.

The Disposal of Sludge

The sludge drawn from a sludge digestion tank or from the sludge compartment of an Imhoff tank contains only a small percentage of solids—usually from 4 to 10 percent weight. The excess water must be removed. This is normally done on a sand bed, preferably covered with glass, or by means of vacuum filters.

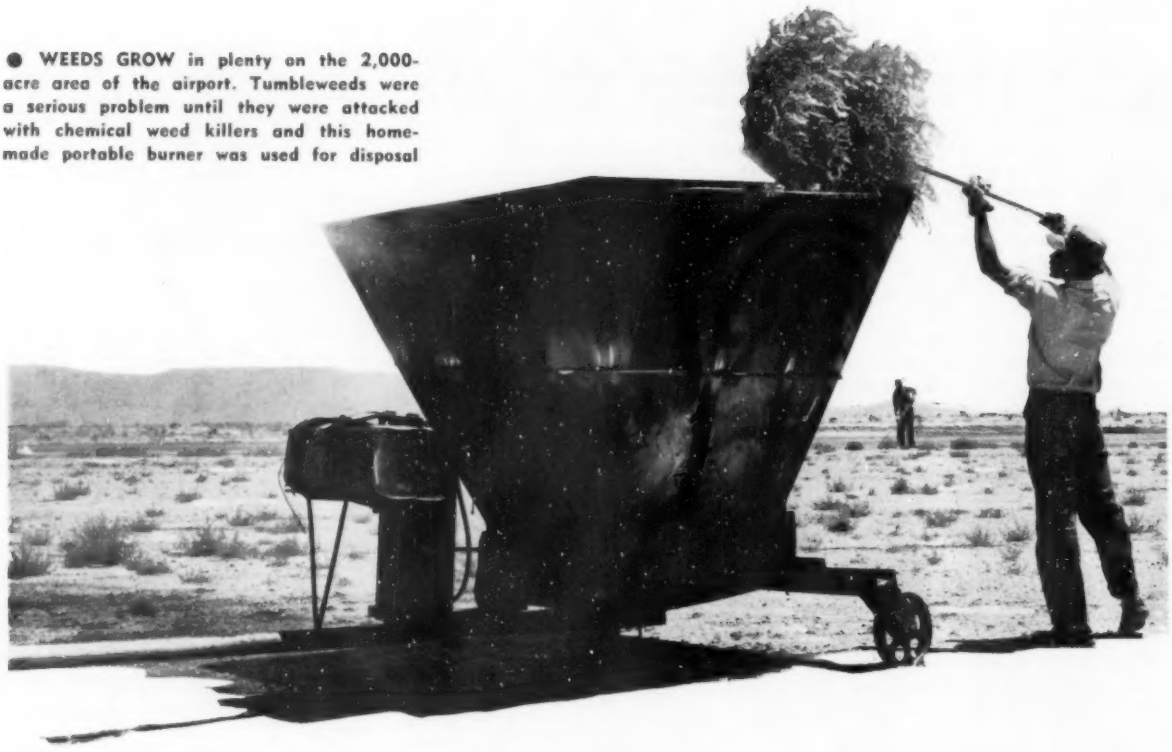
If the moisture content of the sludge can be reduced to 65 or 75 percent, the sludge can be used as a fertilizer for parks, grass plots, farms, etc.; or it can be stored, or burned in an incinerator. It should be noted that sludge with 5 percent solids and 95 percent water is six times as bulky for the same amount of solids as sludge containing 30 percent solids and 70 percent moisture. In other words the relative volume of two sludges varies with the solids content.

After it has been properly digested, sludge has little disagreeable odor and when properly dried or dewatered thereafter is unobjectionable. The removal of the excess water is necessary to facilitate final disposal.

Sludge Beds. A sludge drying bed consists of a layer of 6 to 12 inches of sand, supported on 6 to 12 inches of graded gravel, under which are placed open joint drains. The water drains out of the sludge, and evaporates from it also—both actions being important. That part of the moisture which drains out passes down through the sand and gravel and into the underdrains which may discharge, after chlorination, into the outlet sewer from the plant; or preferably into a pump sump from which it is returned to the sedimentation tank.

Sludge drying beds may be open or covered. Structures similar to greenhouses are used for cover-

(*Continued on page* 154)



● **WEEDS GROW** in plenty on the 2,000-acre area of the airport. Tumbleweeds were a serious problem until they were attacked with chemical weed killers and this home-made portable burner was used for disposal

AIRPORT MAINTENANCE:

All the problems of a small city and a lot of others besides.

R. W. F. "BOB" SCHMIDT,
Manager, Tucson Airport Authority,
Tucson, Arizona

THE ALL-INCLUSIVE phrase commonly employed "soup to nuts" falls short by a country mile of blanketing the items and problems of maintaining a modern airport of terminal proportion. While Tucson Municipal Airport, "Arizona's Airport", as advertised and publicized for nearly a decade, is not altogether modern and certainly no LaGuardia, Midway, or Moisant, it does have the nation's longest civil airport runway—12,000 feet, soon to be 15,000 feet. It has experienced five years of substantial jet operation so that its aircraft handling capacity is right up there with the big city boys.

First, because of advantageous geographic and climatic position, the operating agency, Tucson Airport Authority, does not have the more typical problems of snow removal, high moisture content of soils with damaging freeze and thaw cycles, and major winterization programs. Neither does it have a serious problem of vegetation removal, although many airports have been able to convert this apparent loss into interesting revenue producing assets with crops ranging all the way from asparagus and lettuce to melons and hay.

Second, the activity at the airport is widely diversified, from the usually accepted and understood personally owned business and pleasure aircraft through the charter and executive categories to airline use of DC-7s and Constellations, on to industrial and military operations consisting of small aviation and electronic plants. Also, carried on here are the Douglas Aircraft Company and Air Force production, flight testing and modification work on DC-6, RB-66, B-47 and similar types, Hughes Aircraft Company missile production activity, the Air National Guard, and operation generated by a modestly growing civil and military transient fueling business. The airport cannot be considered typical. In fact, it is one of the few public airports in the nation which has no access to local tax monies for any purpose, and since it must make its

● **MAINTENANCE** work is almost endless. Here are some essential tools.

way from scratch in all departments, it is unique.

Maintenance falls into four classes, namely:

(1) *Regular,* recurring, daily to weekly "housekeeping" from janitor functions to trash collections and routine oiling; lamp replacement; window washing; floor waxing; fence patrol; and litterbug trailing.

(2) *Periodic,* two to twelve times annually, such as converting from heating to cooling and vice versa; application of weed killer; wear and tear painting; crack filling of pavements; roof leak checks; mowing; ditch cleaning; equipment repair and overhaul.

(3) *Program* or planned well in advance undertakings. This includes reroofing buildings; painting exteriors; replacement of pavement; seal coating; and work generally accomplished on a one to ten-year cycle depending upon use, ravages of weather, location, appearance and economic importance.

(4) *Special,* those items which, while not unanticipated, are the result of unforeseen circumstances. Examples are when electric cables blow out; a well motor freezes; a storm rips off roofing and threatens damage to the building interior and contents; an accident; and similar situations. These experiences always develop after the regular maintenance crew has left for the day, on Sundays or holidays, and when the most experienced man to handle the rehabilitation task is ill or on vacation!

The first three classes are simple to forecast and incorporate in a budget. The area to be covered, the number of units to be maintained, the degree or standard of maintenance desired, the probable number of users or impact of the elements, costs of labor, materials, equipment and outside services are not too difficult to assimilate and project over a biennium.

The fourth class becomes easier to contemplate with the passing of each year as we develop an experience record, replace questionable facilities or units we inherited about which we knew little or nothing and of which there were no assuring records of time of installation or the quality of materials or workmanship.

Maintenance Equipment

The type and make of equipment used in the maintenance program varies appreciably because some of it was inherited and some of it was purchased second hand when the Authority lacked funds to purchase new and perhaps better suited devices. Also, some of it is the result of a planned purchasing program to develop a fleet or reservoir of rolling stock and allied equipment and tools. The principal items are:

Massey-Harris Work Bull model 202 with a Davis double cylinder end loader and a Gannon Earthcavator; Jay tamper model 12; International Metro truck used and developed by Maintenance Superintendent F.M. "Mike" McLean, who also doubles as airport electrician. McLean added a deck on the roof of the truck from which a 30-foot ladder is hinged and supported with stiff arm and cables. He also installed a collapsible portable boom carried inside from which a coffin hoist picks up motors, manhole covers, and other heavy objects. The truck also contains a work bench, storage shelves, first aid kit, fire extinguisher, fireman's turnout, volt/amp meter and megger, rubber gloves, hot stick, vise, and other tools.

Also a Chevrolet ¾-ton stake truck; Ford ½-ton pickup truck; Dodge ½-ton panel truck; GMC 1 1/2-ton panel truck with painter's ladders; a Federal 2½-ton dump truck; GMC ACR pumper converted to a utility truck with boom; Gar Wood 3-ton hoist; 5-kw generator; 1 1/2 hp vacuum cleaner; White weapons carrier lowboy; Clark fork lift, 3-ton, 26 ins.; International T-6 tractor; International Farmall model 8 on which is mounted Auburn trencher.

Ford coupe for onfield labor transportation; Caterpillar Model 30 with dozer; Caterpillar motor grader; Sears Roebuck rubber tired wagon trailer used for weed haul; Worthington air compressor, 105 cfm, on which is mounted a D79 Gardner-Denver sinker drill used for setting fence posts and drilling holes in concrete; 500-gallon tank trailer with Wisconsin engine and salvaged pump equipped with spray bar, hand spray, and shower head for weed killer; Lincoln 200-amp arc welder; Cleveland jack hammer model 811; 5 hp Lynch air compressor; 10-in. table saw; band saw; Tennant joint cutter; Markright paint sprayer; 8-ft. Chicago brake; electric shears for up to 16G metal; Ramset stud gun, 22 and 38;

● **LIGHTING maintenance problems, too, are found at the airport. A ladder built on a Metro-International truck is demonstrated by Maintenance Sup't. F. M. McLean.**

and 1/4-in. and 1/2-in. Whitney-Jensen punches.

The above items with the usual dies, threaders, wrenches and hand tools comprise the maintenance equipment. More than a million square feet of building area, 225 acres of Portland cement and asphaltic concrete pavement, nine miles of fence, six wells, three reservoirs, twelve miles of underground cable, and countless thousands of feet of water, sewer, and open ditch lines are maintained.

A once serious problem, that of tumbleweeds, has been reduced to a minimum of effort through a two-pronged campaign of application of weed killer in specific areas where we want bare ground. We fork the weeds into a shop-built burner in those areas where we want to encourage native grasses and lesser brush to take over. The burner is simply a large hopper with a fuel tank piped into the bottom with an old engine sleeve welded into the bottom of the fire box, through which a Hudson weed burner heats the pipe with waste oil, keeping a hot flame in the fire box. Other vegetation is mowed when it reaches desired height—tumble weeds are burned green if possible, but if they've matured and "tumbled" they're gathered in the trailer and hauled to the burner. The dual attack is eliminating tumbleweed from several score acres each year.

Work Performance

The Maintenance Superintendent and nine men are used to perform most of the maintenance cited in the three classes of Periodic, Program, and Special although outside services are used on larger utility, roofing and paving projects. Virtually all of the first class, Regular maintenance, except for trash haul and fence patrol, is handled by a Terminal Maintenance Foreman and five janitors who cover some 20,000 square feet of high density use space in four buildings and do some outside work in the area.

Of this total of sixteen men, about six double in brass because, except for painting, there is not enough work in the specialist fields to justify full time employment save in catch-up periods or on specific undertakings. Consequently, we find the carpenter supervising the installation of fence; the Terminal Foreman utilizing his skill as a welder; the "heavy" equipment operator serving as the pickup man on trips to town in the station wagon (assigned to our Security Department); a laborer inspecting roofs and patching them as required; another laborer reading water meters at month's end; and the Superintendent acting as purchasing agent. To the organization-chart-minded, there are even further horrifying examples of inefficiency in that our Fire Department performs some of the mechanical overhaul work, checks the chlorinators in the domestic water system, turns outside lights on and off, and maintains its own equipment. Further, the Terminal Foreman also collects coins from parking meters and those vending and service machines which we operate ourselves and supervises the photo-mural program in our airline terminal.

A janitor is on duty at all times, and a maintenance man is on duty seven days a week, although the regular maintenance crew puts in a forty-hour week Mondays through Fridays. Since the Security and Flight Line Departments operate around the clock, a minimum of six people are on duty to assist the one to three Maintenance Department people in holding the lid down until relief can be brought in or until the next regular work day as required.

Maintenance costs at the end of the last fiscal year and the beginning of the current biennial budget period, were $232,818.70. The present budget for 1957-1958 is $271,000, and the sharp increase is primarily because of (a) deferred maintenance in the Program class because of construction influences and a drop in income in 1953-1954; and (b) anticipated situations in the Special class. As of May 31, 1957, one third of the budget period—eight months—costs were running approximately $10,000 behind projections.

A breakdown of the 1957-1958 Maintenance and Repair Budget for the period October 1, 1956—September 30, 1958, is: Field area $90,000; marking $7,000; hangars $55,000; lighting $5,000; utilities $10,000; public areas $18,000; terminal buildings $44,000; spur siding buildings $6,000; fire station and shops $10,000; and service equipment $26,000.

The greatest single problem to be faced is time lost in transit. With more than 2,000 acres over which to roam, and the necessity of staying off the landing area except when working on it, mileage piles up rapidly. The fact that it is occasionally necessary to break off one to three men to send them to help at Ryan Field, a second airport operated by the Authority some sixteen miles distant, further aggravates the situation. As time goes on, with newer facilities and increased work load, it appears that the expansion of the sector method of maintenance, except for highly specialized and universal items such as electrical work and painting (runways and taxiways have to be painted too), will have to be employed. This, of course, brings up the need for additional equipment and the expansion of shop facilities to maintain and dispatch equipment. Our present shop facilities, which include covered storage for all units save the weed burner and the bulldozer, are adequate space-wise and excellent otherwise, but as we contemplate development of the airport, are in the wrong place! However, fortunately we find other uses and users for our buildings as we go along, and very likely the revenues obtained from renting the present space will go a long way toward paying for new space more advantageously situated. Our prime advantage is that we have a growing, expanding operation which offers opportunity to correct deficiencies and realine our sights as we re-evaluate our position. We hope that we can corral the loose ends before reaching a static plateau if, indeed, that day ever arrives. Today it seems more distant than yesterday!

● **PATCHING pavement surfaces is expedited by a Jay tamper which is shown here compacting an asphaltic concrete patch. See text for listings of equipment.**

ELECTRONIC TRAFFIC CONTROL for ORLANDO

C. E. WRIGHT

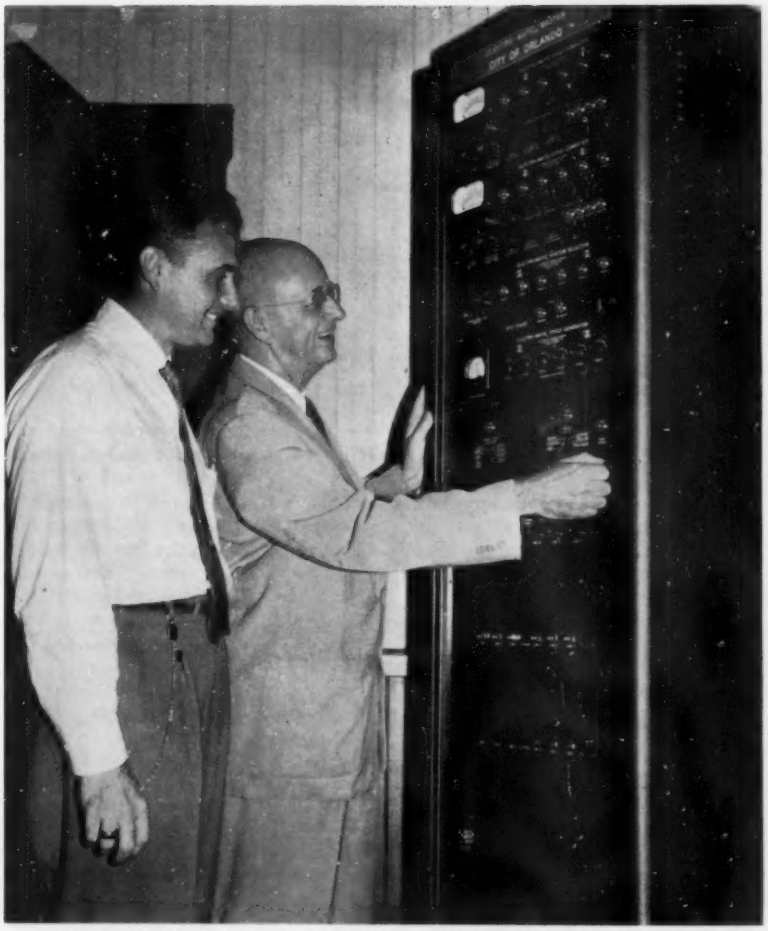
THE INITIAL installation of an electronic traffic control system for Orlando, Florida, cost $26,000. It covers two principal arteries, 28 intersections and 27 traffic lights, and will eventually be expanded to two other streets. It will then encompass the entire downtown business area.

The system selected for Orlando is the PR System of Coordinated Traffic Control, manufactured by the Automatic Signal Division of Eastern Industries, Inc., which operates with the traffic analyzing features of a master control and local controllers. Detectors at the various locations within the grid system keep the master control, situated in a control room in the City Hall, informed at all times of volume and direction of traffic.

The system operates automatically to equalize the traffic flow. When traffic in one direction is heavier than in the other, lights for the heavier flow are kept on longer to clear up the congestion. During rush hours the lights automatically favor north-south or east-west flow which ever may be the heavier.

Like many cities of its size and particularly those which have grown rapidly in recent years, Orlando is partly a one-street town. On Orange Avenue, its principal thoroughfare, are the leading hotels, stores, banks and office buildings, all tending to draw a large number of vehicles to a closely knit business area. Further complicating the traffic situation both for vehicles and pedestrians is the fact that Orlando is a tourist center. During February, the peak of the winter tourist season, vehicular traffic is up about 20 percent over the norm for the remainder of the year.

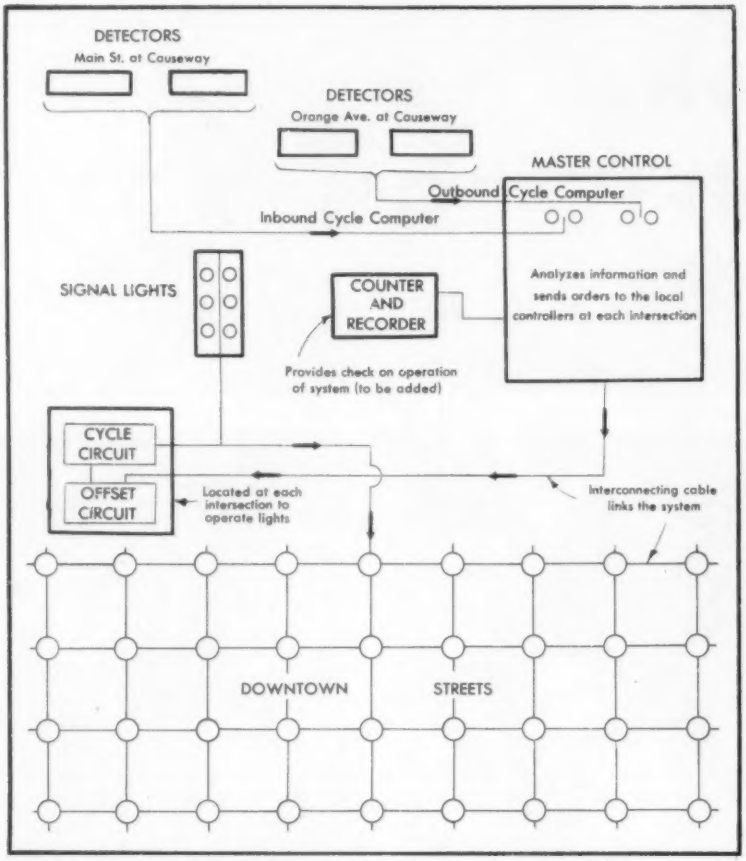
Some years ago Orlando put in a downtown traffic system which favored the pedestrians. At four intersections on Orange Avenue four-way stop signals held up all motor traffic and permitted pedestrians to cross in any direction, including diagonal. This "amble-scramble," as it is called locally, worked well until motor traffic began assuming much larger proportions as compared with pedestrian traffic.



● **MASTER CONTROL board of Orlando's new electronic traffic control system is examined by Mayor Robert S. Carr (right) and City Traffic Engineer D. W. Barry.**

By means of Streeter-Amet traffic recorders, surveys of traffic movements and speed delay studies on Orlando's principal downtown streets were made by City Traffic Engineer Donald W. Barry. It was found that vehicular traffic on Main Street, which parallels Orange Avenue, moved more expeditiously than on Orange Avenue with its "amble-scramble" crossings.

Along with this, traffic recording studies were made of the effect of



● **HOW IT WORKS: Diagrammatic layout of the master traffic control system.**

the four-way crossings on both moving vehicles and pedestrians. The plan was originally put into effect to give those on foot a "break," but in actual practice it has not worked as well as might be expected. The "amble-scramble" period was only 20 seconds, then if pedestrians were caught by the "wait" sign they had to stand, sometimes in a broiling sun, for 50 seconds for another walking period. Moreover, only about 20 percent of the pedestrians walked diagonally, thus penalizing the other 80 percent, who could under the normal crossing procedure go in some direction at any time.

With the new system of coordinated traffic control, the diagonal traffic crossing will be eliminated; also four-way vehicle stops. Thus traffic will move at 60-second intervals and pedestrians are able to cross in some direction at any time.

"The four-way stop system has its advantages, especially for pedestrians," said Traffic Engineer Barry, "but these are outweighed by the disadvantages. We were forced to conclude that it is not sound engineering practice in view of the heavy increase in automobile traffic." Pedestrians are being encouraged to go to the nearest lighted intersection to cross. "You've got to do one thing or the other," said Mr. Barry. "You cannot keep vehicular traffic from jamming up if there are too many stops."

In its initial operation of the coordinated control system during early May, Orlando did not immediately discontinue the four all-red pedestrian intervals on Orange Avenue. The result was that traffic did not move with the same speed on that street as on the other streets which did not have the "amble-scramble," a fact which hastened the demise of that out-moded phase of the old system.

"By separating pedestrian and vehicular travel we have reduced pedestrian conflict at crossings and have eliminated some traffic bottlenecks," said the city traffic engineer.

The radar detectors installed as a part of the new electronic system are not pressure sensitive and, according to the traffic department, "are more economical and more flexible" than those that have previously been installed elsewhere in the country. They detect the volume and flow of traffic in each lane of two-way streets. The vehicles themselves dictate the operation of the system. While only one grid system was installed initially, the city will eventually have four. An extension of one-way streets in the downtown district is planned as a part of faster movement of vehicles.

In the surveys preliminary to adoption of this new system, the Orlando traffic engineer patterned his procedures along the lines recommended by the Institute of Traffic Engineers, the Automotive Safety Foundation and various consulting traffic engineers. As applied to Orlando's particular problems, the studies and surveys included:

1. Vehicular volume flow analysis adjusted to a daily annual average value;
2. Vehicular turning movement analysis at critical intersections;
3. Pedestrian movement analysis at intersections in the core area—the downtown business district;
4. Speed-delay analysis, forming an index of efficiency of traffic operation on the various streets;
5. Inventory of in-place traffic facilities, including signs, signals, markings, street widths, etc.;
6. Compilation of statistical data on population growth, vehicle registration and related information affecting the general traffic condition of the city.

The greatest volume of traffic was found to be on Colonial Drive, a new wide east-west highway which is a part of State Road 50, a cross-state artery which carries a good deal of tourist traffic along with local traffic. This highway had 20,000 vehicles a day. Next came Orange Avenue, the main north-south business street, with 17,000 a day. Then Garland Avenue, a north-south thoroughfare with 13,000. Another 12 business streets in the center of the city ranged from 12,000 down to 5,000 a day.

In pedestrian studies, the number of people observed totaled 57,468. Of these, 33,180 were present at the "amble-scramble" intersections, where it was observed that only 20 percent took advantage of the diagonal or angle crosswalk. It was also discovered that the pedestrian was immobile for 70 percent of the time and walking only 30 percent.

On one of the principal east-west streets the overall travel speed was 15.06 miles an hour, which slowed down to 4.1 miles in the core area. Another east-west street showed 16.64 miles an hour, while others were 14.34 and 11.2 miles.

● WIDENED and relocated channel of Mill Creek. With a drainage area of 165 sq.mi., flood volumes reach 18,000 cfs.

CHANNEL IMPROVEMENT

Reduces Flood Damage and Reclaims Land

BERNARD H. KOCK,

Principal General Design Engineer,

City Engineering Division,

Cincinnati, Ohio

A CONSIDERABLE segment of the business and industry of Cincinnati and Hamilton County, Ohio, is located in the valley of Mill Creek, a stream of highly variable flow, which roughly bisects the corporate area of Cincinnati. The value of investment in this area has not been estimated recently, but probably is in excess of $300,000,000, with an additional $200,000,000 or more located in political subdivisions adjacent to Cincinnati and in Hamilton County. Mill Creek Valley also contains the freight yards of three major railroads and the Cincinnati Union Station, serving the passenger lines of seven trunk line railroads.

The Valley area abutting both sides of Mill Creek has always been subject to back flooding from the Ohio River and to flash floods arising in the headwaters of the Creek. In 1948, however, the Corps of Engineers in cooperation with the City of Cincinnati, completed the Mill Creek Barrier Dam, which eliminated all back flooding from the Ohio River, thereby freeing about 4.5 square miles of level land for further industrial development.

During flood periods in the Ohio River, Mill Creek is bulkheaded near its junction with the river and the entire flow of the creek is pumped into the river. Six pumps have been provided at the Barrier Dam, each with a rating of 1500 cfs at a head of 29 feet for a maximum discharge of 9000 cfs. Space is also available for 3 additional pumps if needed. The balance of the discharge of Mill Creek (maximum flood flow at mouth is 18,000 cfs) was initially provided for in reservoir pondage behind the Barrier Dam. Unfortunately with Ohio River backwater eliminated, the pondage area is rapidly being lost through expansion of railroad and industrial areas, thereby providing a compelling reason for developing substitute pondage in a widened, realined and improved Creek Channel.

Other reasons, just as compelling, are the flash flood characteristics of Mill Creek, which always must be considered in engineering planning; the pollution of creek flow by industrial waste; and uncontrolled dumping within the channel area. A project known as the West Fork Reservoir, to eliminate some of the flash flooding of Mill Creek was completed several years ago by the Corps of Engineers. This reservoir has a storage capacity of 9500 acre-feet equivalent to a flow of 1600 cfs over 72 hours, or a peak flow of 3000 cfs. The rapid development of industry in the Mill Creek Valley, however, will eventually offset some of the retarding effect of the reservoir, particularly as far downstream as the Cincinnati area.

Some of the other characteristics peculiar to Mill Creek Valley and Channel are:

The watershed area is 165 sq. mi. with its length 29 mi. and its width 12 mi.; 40 sq. mi. of the watershed is in Cincinnati and 21 sq. mi. in neighboring towns and villages. The flood plain width at the headwaters of the creek is 1600 ft. The channel width at the lower end of the creek is 130 ft. and at the upper end 80 ft. The maximum discharge of the creek is 18,000 cfs and the minimum discharge is 35 cfs. The alinement of the stream near its outlet is fairly straight.

All of the factors mentioned have been fully recognized for the past ten years, but could not be resolved because of the lack of financing. In March, 1948, a study and report of the overall improvement of the Mill Creek Channel was made for the State of Ohio, by the engineering firm of Vogt, Ivers, Seaman and Associates. This report listed priorities of channel improvement in critical areas, and established rec-

● **CHANNEL before improvement, showing poor alinement and debris and trees which greatly reduced flow characteristics and resulted in costly flood damage.**

● **AFTER improvement: Section of channel as shown above after straightening, clearing and building retaining wall. See also channel section shown on page 133.**

ommended channel widths, gradients and bridge clearances. The City Council of Cincinnati accepted the general recommendations in the report and passed an ordinance defining the future channel lines of Mill Creek. This made it possible for the first time to control the issuance of permits for building construction adjacent to the channel.

Salway Park Improvement

Actual channel improvement in the most critical area was initiated in 1955 through the proceeds of a referendum bond issue, approved by the public. This consisted of a widened and relocated earth channel in the Salway Park Area 2600 ft. long, with a bottom width of 100 feet and side slopes of 2 on 1, with an average depth of 15 feet. A major feature of this improvement was the reclamation of 9 acres of Salway Park for recreational purposes, in an area formerly valueless because of the meandering course of the old channel. The construction cost of this project was $99,895.

To maintain the stability of the new channel through Salway Park a rather sharp realinement of the creek at the head entrance of the relocated channel was necessary. This realinement, 500 ft. in length, was complicated by a skew railroad bridge and by factory sidings, structures and processing equipment closely adjacent to the proposed channel. The type of construction finally adopted consisted of precast concrete crib walls varying from 6 feet 11 ins. to 22 feet 6 ins. in height. The design sections employed were those recommended by the Massey Concrete Products Company, manufacturers of the cribbing. However, the backfill procedure within the crib cells was changed by the City because of the fluctuating water levels in Mill Creek; that is, the waterward tier of all crib walls was filled with broken, laurel type, limestone 6-in. and 4-in. sizes, obtained from quarries near Versailles, Indiana.

The weight of the limestone in cars as delivered, amounted to 90.4 pounds per cubic foot. This was probably increased slightly after placement in the crib wall tiers but is still below the manufacturer's recommendation of 100 pounds per cubic foot. However, the self-cleaning and non-washing features of the stone compensated for the lack of weight which was further equalized by keeping live load surcharge, from railroad sidings, less than the manufacturer's design allowance, through proper positioning of the crib wall.

The landward tier of the crib wall was backfilled with bank run gravel 3-in. maximum. To prevent stream action from undercutting the crib wall, stub steel sheet piling was driven 5 feet from the toe of the wall to an elevation 2 feet above low water with a penetration of about 8 feet. The space between the piling and crib wall was backfilled with rock and the top paved with concrete. Where ground water was present in substantial quantity, the bottom of the interior of the waterward crib cells was lined with a layer of clay 6 inches thick. Some difficulty was experienced because of numerous and previously unknown seepage lines from industry, which required cutting of cribbing and use of special members. Foundations for the crib walls ranged from gravel to muck. Where the latter was encountered, a blanket of bank run gravel was placed before installation of the cribbing sill. Settlement of cribbing even in sections with poor foundation has been negligible. For future maintenance, the earth slope (2:1) was started at the back edge of the rock filled crib.

Construction costs for the initial cribbed section of Mill Creek applicable to the wall and channel and excluding remodeling of factory structures were $230,440.

Additional Construction

Funds now available will permit the construction soon of an additional mile of widened and relocated channel. Restricted clearances due to adjacent highways, railroads and buildings, will require the use of cribbing on all of this additional construction. A dry-weather channel in the center of the widened and realined channel to drain stagnant pools during drought periods is also planned. This will consist of a half-pipe section 48 ins. in diameter, flanked by concrete strips 6 feet wide. A fully paved channel bottom would be desirable, but bottom widths of 60 to 130 feet make this impractical. To keep the summer channel clear, a rubber-tired, end-loading vehicle will be used.

The earth channel in Salway Park was constructed in approximately 6 months during the latter part of 1955. The cribbed channel was completed in 6 months during the winter of 1956 and the spring of 1957. The project was planned and designed by the writer under the general direction of T. J. Montgomery, City Engineer, and W. C. Wichman, Director of Public Works, based on hydraulic recommendations in the report of the State of Ohio.

● **REFUSE** is collected by packer-type trucks and dumped into the trench where it is spread and compacted by tractors.

● **COMPACTION** greatly reduces the refuse volume. The compacted refuse is covered with 6 ins. of dirt every evening.

SANITARY FILL Ends 50 Years of PUBLIC NUISANCE

CHARLES HERMAN SCATES,
Sanitation Officer,
Union City, Tennessee

MORE THAN 50 years ago Union City, Tenn., purchased eight acres of low lands and pond for use as a dump ground; and for almost all of that half century, this area has produced smoke, smells and an assortment of rodents. Now the fires have been extinguished, the odors have been sealed in, and the rodents have lost their haven. Sanitary landfill operations are in effect.

Since 1904, when the land was purchased, it had been used as an open dump, with no planned maintenance. In August, 1956, a modern sanitary refuse collection and disposal program was inaugurated. A Caterpillar D6 Tractor was purchased and put into full-time operation on the landfill. Two 16-yard Hyde-Paks on Chevrolet chassis and one 10-yard Pak-Mor on a Ford chassis were purchased for garbage collection.

In the residential sections, the two 16-yard packer trucks make two pickups each week, working on Monday-Thursday and Tuesday-Friday schedules. The three-man crews haul two loads a day to the landfill, covering 3068 residential stops. On Wednesdays, two flat-bed trucks are used to collect limbs, stumps and refuse the packers cannot handle.

A night crew, using the 10-yard packer truck, collects from the business section. The 350 commercial stops are serviced six nights a week, between the hours of 5 pm and 2 am. This schedule helps to reduce traffic congestion with other trucks in alleys and permits 100 percent coverage. Then the streets are washed and swept, starting at 2 am, providing a thoroughly cleaned downtown area when the merchants open each morning.

Each business must provide containers approved by the Obion County Health Department. When containers are no longer satisfactory, the merchant concerned is mailed a notice. If no corrections are made, the obsolete containers are hauled away as refuse. For this pickup service, merchants are charged from $1 to $6 per month.

Strict sanitary procedures are carried out with visiting shows, carnivals and circuses. A refuse service fee is collected before the permit to perform will be issued. In return, the sanitary division provides sufficient approved containers and collects refuse daily, at an hour agreed upon with the show management.

Landfill Operation

The landfill is operated five days a week, from 7:00 am to 5:00 pm. As each truck dumps its load in the trench, the D6 spreads and compacts the refuse. Each evening six inches of dirt from the bottom of the trench is spread over the fill. When the trench has been filled, a final cover 24 inches thick is spread over the top, and the surface is graded. Dirt is stockpiled on each side above the trench for use as cover when the trench is wet.

The first trench lasted Union City 30 days, the second 60 days. The present trench, 60 feet wide, 300 feet long and 8 feet deep, has been used since the middle of December, 1956, and will be available for another 10 months.

A special area has been constructed to one side for the burning, once a week, of stumps, limbs, grass and all refuse collected on the flat-bed trucks on Wednesdays.

When the present trench has been exhausted, space remains on this 8-acre plot for a fourth and fifth trench. The fourth one is now being excavated by the D6, pulling a LeTourneau scraper. Another 72 acres, adjacent to the present site, has recently been purchased, providing sufficient area for developing picnic, park area and bridle paths. There is enough low land in this tract adjacent to the present landfill to provide landfill operations for the next 25 years. The reclaimed land, once smoky, smelly and rodent-infested, will be used for park development.

State Operated Asphalt Plant

Helps Resurfacing by Force Account

F. J. RUSSELL,

Engineer of Maintenance,

Mississippi State Highway Department

ALL MAINTENANCE operations on the Mississippi State Highway System are performed by employees of the State Highway Department with Department owned equipment. It is the State Highway Commission's policy to contract addition and betterment jobs of sizes which are attractive to contractors; however, there have been a few jobs where exceptions to the policy have been made. The exceptions include the operation of a State owned asphalt plant in resurfacing bituminous pavements and surface treatments.

A large area located in the southeastern part of the State, including the entire Gulf Coast, has numerous surface deposits of sand and sand-gravel which are excellent aggregates for asphalt hot-mix surfacing material. There are several asphalt refineries located within trucking distance, one of which is located within the area. The Highway Department has contracts with these refineries to deliver all grades of asphalt, diesel fuel and burner fuel to state owned storage tanks, by truck tank, anywhere in the State.

After experimenting with the local material on small jobs for two or three years, the district engineer for the Sixth District decided to take advantage of these favorable conditions by producing the hot-mix materials, and resurfacing his bituminous pavements with state forces and equipment. For the past ten years the operation has been continuous through all the seasons of the year. The high quality of the surface built, and the low cost of the surfacing material in place on the road have justified the department in performing this particular operation with State forces and equipment.

When sections of asphalt surface in a particular area have been selected for resurfacing, the assistant district engineer in charge of maintenance investigates all possible deposits of sand and semi-gravel in the area. He then selects a deposit of material which appears to be of good quality and in the most convenient location in respect to the roads to be resurfaced from the proposed set-up of the plant. Samples of the aggregate are sent to the district laboratory where tests are

● DISCHARGING the mix from the pugmill into a truck. Depending on length of haul, 8 to 12 2-ton trucks are needed.

● SETTING up the plant at a new location. Site is prepared first. Boiler, dryer and storage tanks are shown in place.

made, gradation of the material is determined, and the mix is designed. The sand-gravel deposit in many pits proves to be a one-way material for a hot-mix. That is, the aggregate does not require adding and blending other material. The grade and quantity of asphalt required for the particular aggregate is determined by the laboratory technicians.

Some of the plant locations have been adjacent to the road to be resurfaced and some have been as far as two miles from the nearest resurfacing job. Water for all purposes is obtained by sinking a well-stem on a 2-in. pipe and attaching a pump. In some areas good water is found 35 to 40 feet below the surface, and the well is constructed by the state crew. In a few locations a well driller has been employed to sink a well as much as 350 feet.

Site Preparation

Before the plant equipment is moved to a new location the entire area is cleared of trees, brush, vegetation, and top soil down to a uniform material with a dozer and motor grader. A road is constructed between the plant site and the highway. The plant superintendent, with the approval of the engineer, plans the exact location or set-up of the drier, mixer, weighing scales, water tank, asphalt storage tanks, etc. Storage tanks required are: One for burner fuel for boiler and drier; one for diesel fuel for motors operating the drier and pugmill; one for AC-8 asphalt; and one for AC-15 asphalt. With his past experience, it appears to be no problem for the superintendent to erect the plant as it is hauled to the site piece by piece.

One-way material or blended material is piled against a bulkhead adjacent to the drier with a dozer or front-end loader where it is fed by a shuttle feeder through an opening in the bulkhead and to the drier by a small mechanical bucket-conveyor. The drier consists of dual rotating drums, each supplied with two burners. Asphalt is delivered to the storage tanks by trucks at a high temperature, and the desired temperature is maintained by steam coils.

The dry aggregate is fed to the pugmill with a chain bucket conveyor while asphalt cement heated to 260° is being added. The mixed material moves directly from the plant to trucks which haul it to the road. It requires from 8 to 12 two-ton trucks to move the material from the plant to the road, depending on the length of the haul. The plant has 60 tons per hour capacity, but the average output at a setup is usually 400 tons or less per 8-hour working day.

Grade AC-8 asphalt is used in the mix for the first or leveling course, and AC-15 is used in the second or wearing course. It usually requires approximately 75 pounds per square yard for each course, or a mat of 1½ ins. average thickness. This first course is usually spread with a motor grader, and the final course is placed with an asphalt spreader. A tack coat of 0.10 gallon or less of emulsified asphalt per square yard is sprayed on the surface before the first course is placed. Each course is compacted with a 5-ton roller.

The District Laboratory at Hattiesburg found that an average of all samples taken from the plant compared very closely with the pilot sample.

The leveling course is applied well in advance of final course and practically all of the leveling course is laid in hot summer months and then allowed to weather and carry traffic. The road is kept open to traffic during the resurfacing operations, which necessitates placing one half the surface width at a time. Operating under these conditions requires more time and care and adds to the cost. This procedure also requires the use of flagmen and special signs.

The total cost includes that of dismantling the plant, moving it to the new location, and reassembling the various units, as indicated in the cost record below; but our costs do not include some that a contractor must include, such as a performance bond, profit, and others. However, the Mississippi Highway Department carries liability and property damage insurance on all motorized equipment; pays part of the premium on life and hospital insurance for employees; allows one day a month each of annual and sick leave for regular employees; and pays good salaries on a monthly basis. These employee and public benefits are reflected in the total cost of the resurfacing material in place.

The plant, as set up for operation, presents a rather crude appearance. But those in charge of the plant are concentrating their efforts on keeping each unit in good operating condition, and are more interested in the quality and unit cost of the material produced than in the appearance of the plant. Too, the plant remains in a location for only 9 to 15 months, and has been dismantled, moved, and set up no less than twenty times.

Cost Data

Operations at the Baxter location were started on July 7, 1955, and work was completed at this setup on April 18, 1956. The plant operated 165 working days during this period,

● **START of a resurfacing job. Following application of a tack coat, two courses are placed, each about 1½ ins. thick.**

● **AFTER six years of service, this surface is still in excellent condition. Careful control results in good wearing surfaces.**

Table 1—Asphalt Plant Costs for Set-Up at Baxter

	Total Expenditures	Cost per Ton
AGGREGATE PRODUCTION (60,309.51 tons)		
Labor	$ 10,673.92	$ 0.1781
Purchases	1,274.28	0.0213
Equipment Rental	20,349.19	0.3396
Supervision	1,125.60	0.0188
Total	$ 33,422.99	$ 0.5578
ASPHALT (60,309.51 tons)		
Labor	$ 821.22	$ 0.0137
Purchases	97,948.53	1.6348
Equipment Rental	3,382.30	0.0564
Supervision	....	....
Total	$102,152.05	$ 1.7049
PLANT OPERATION (60,309.51 tons)		
Labor	$ 18,066.38	$ 0.3015
Miscellaneous Purchases	940.43	
Dryer Fuel	20,949.35	0.3653
Equipment Rental	22,531.83	0.3761
Supervision	819.78	0.0137
Total	$ 63,307.77	$ 1.0566
STREET OPERATIONS		
COST OF HAULING MIX (54,462.005 tons)		
Note: The following unit costs are an average for comparison only. Actual hauling costs were computed on ton-mile basis.		
Labor	$ 11,412.35	$ 0.2095
Purchases	....	....
Equipment Rental	23,549.32	0.4324
Supervision	819.79	0.0151
Sub-Total	$ 35,781.46	$ 0.6570
SPREADING, FINISHING AND ROLLING (54,299.105 tons)		
Labor	$ 14,021.21	$ 0.2582
Purchases	....	....
Equipment Rental	8,043.38	0.1481
Supervision	819.79	0.0151
Sub-Total	$ 22,884.38	$ 0.4214
Total All Street Operations	$ 58,665.84	$ 1.0784
MOVE-IN COST (60,309.51 tons)		
Labor	$ 2,813.33	$ 0.0470
Purchases	56.43	0.0009
Equipment Rental	1,750.23	0.0292
Supervision	65.90	0.0011
Total	$ 4,685.89	$ 0.0782
Grand Total Cost — $262,234.54		

Table 2—Summary of Cost per Ton

	Labor	Purchases	Rental	Supervision	Total
Aggregate Production	$0.1781	$ 0.0213	$ 0.3396	$ 0.0188	$ 0.5578
Asphalt	0.0137	1.6348	0.0564	....	1.7049
Plant Operation	0.3015	0.3653	0.3761	0.0137	1.0566
Street Operations					
Hauling Mix Material	0.2095	....	0.4324	0.0151	0.6570
Spreading & Rolling	0.2582	....	0.1481	0.0151	0.4214
Move-In	0.0470	0.0009	0.0292	0.0011	0.0782
Totals	$ 1.0080	$ 2.0223	$ 1.3818	$ 0.0638	$ 4.4759

producing a total of 60,309.51 tons or an average of 365.51 tons per working day. The cost data for this operating period are presented in Tables 1 and 2.

Detailed costs per ton for two previous locations, Brooklyn and Beaumont, are in the same general range. This also holds true for the 10 set-ups since 1948. At the Brooklyn location, total costs were $4.87 per ton for 16,594 tons and for Beaumont $3.715 per ton for 75,927 tons. In all, 507,811 tons of plant mix have been produced in the Sixth District from February, 1948 to April, 1956. D. B. McCaa is District Engineer; J. F. Calhoun is Assistant District Engineer in charge of maintenance and force account work; and T. W. Herrington is Asphalt Plant Superintendent.

• • •

Garden State Parkway and New York Thruway Linked

The New York State Thruway has opened the 2½-mile spur that joins the Garden State Parkway at the New Jersey-New York line. This interstate connection will tie together two of the nation's longest toll roads and add a link to the chain of superhighways stretching across the Northeast. Connection of the Parkway and the Thruway will, among other things, create the first direct bypass of metropolitan New York City for travel between New England and the South or West.

Their connection will also extend the network of superhighways stretching from Chicago to New York City further north into New York State and, by connecting routes, to New England. The parkway has an existing link in its mid-State area with the New Jersey Turnpike, which presently represents the eastern terminal road of the superhighway chain to and from Chicago.

The metropolitan bypass created by the link-up runs north of New York City, the Thruway crossing the Hudson River over the Tappan Zee Bridge some 15 miles above the George Washington Bridge.

With the link-up at the N.J.-N.Y. line, the Parkway and Thruway will provide an unbroken expressway route of some 575 miles between Cape May City and Buffalo at the western extremity of New York State.

The speed limit on both the Parkway and Thruway is 60 miles per hour for passenger cars. No trucks are permitted on the northern sections of the Parkway.

A PROGRESS REPORT ON THE FIRST YEAR OF THE GRANTS PROGRAM FOR CONSTRUCTION OF SEWAGE TREATMENT WORKS

★ ★ ★ ★ ★

GORDON E. McCALLUM,
Chief, Water Supply and Water Pollution Control Program, Public Health Service, U. S. Department of Health, Education, and Welfare

THE HISTORY of municipal sewage treatment in the United States has been almost entirely encompassed within this century. In 1900 there were some 60 municipal plants that served a total population of less than 1,000,000 persons. Today there are more than 7,000 municipal sewage treatment works that serve more than 65,000,000 people.

This represents a great deal of progress in pollution control in a relatively short time—but it has not been enough. The latest data available to us indicate that there is at present a backlog of needed sewage treatment works construction of more than 9,000 projects.* This tremendous backlog is compounded largely of (1) urban population and industrial growth; (2) the virtual cessation of sewage plant construction during the war period of 1942-1945, which extended through 1946; (3) the slowdown in such construction in 1951-52 during the Korean conflict; and (4) obsolescence of existing treatment works.

Financial Assistance in Retrospect

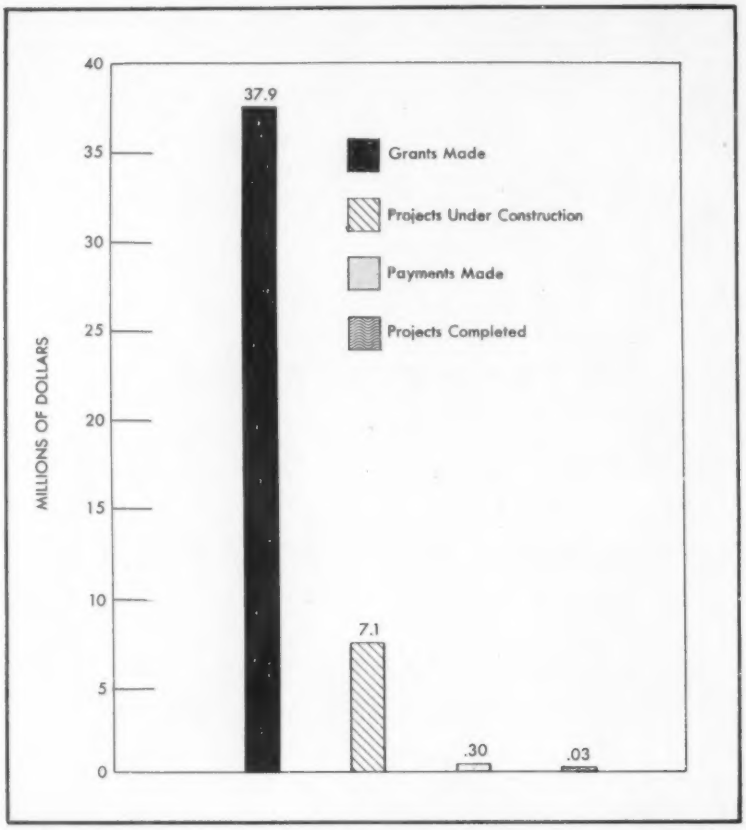
There has been much discussion of Section 6 as contained in Public Law 660, the new Federal Water Pollution Control Act. This section provides for grants to any State, municipality, or intermunicipal or interstate agency for the construction of necessary sewage treatment works, such grants not to exceed 30 percent of the estimated reasonable cost thereof, or $250,000, whichever is smaller.

It should be pointed out, however, that the idea of State or Federal financial assistance for building municipal sewage treatment plants is not new. The Federal public works programs of the 1930's provided for direct grants-in-aid to municipalities for the construction of sewage treatment works. The Congress has considered through the years numerous legislative proposals for pollution control of which most contained some kind of provision for financial assistance. For example, H.R. 2711 (introduced in 75th Congress, 1st Session) provided for grants-in-aid up to 33 1/3 percent of the cost of a project and/or loans to assist municipalities in constructing sewage treatment works. This bill was passed by both the House and the Senate but was vetoed by the President because of technicalities involved in making allocations of funds. More recently, the Community Facilities Act (P.L. 139, 82nd Congress) provided for grants and/or loans to municipalities in defense-impacted areas for the construction of sewage treatment works.

It is significant to note that when comprehensive Federal water pollution control legislation was finally passed in 1948 (Public Law 845, 80th Congress) it was the declared policy of Congress for the Federal program to include financial aid. In keeping therewith, this bipartisan Water Pollution Control Act provided for financial assistance to municipalities in the form of 2 percent construction loans or grants for preliminary planning for sewage treatment works. This policy was reaffirmed by the 84th Congress when it enacted Public Law 660 containing Section 6. Also, nine State legislatures† have passed legislation providing financial assistance as loans or grants to municipalities for sewage plant construction and others are considering such legislation. For the most part, this State legislation has the same purpose as Section 6—to stimulate municipalities to undertake needed construction now.

*Taken from project lists in the State water pollution control plans as published in the Federal Register on November 9, 1956, and revised on February 1, 1957, and April 20, 1957.

†California, Maryland, New York, Pennsylvania, Oregon, New Hampshire, Maine, Ohio, and New Mexico.



● **PROGRESS at the end of the first year of the construction grants program is indicated by these data on grant offers made, construction activity and payments.**

Origin of Grants Provision

During the period when action was underway to revise the 1948 Act, numerous conferences and extensive public hearings were held. At these times it was made clear that nationally we were losing ground in our efforts to control water pollution. During the debate which preceded passage of the new Federal Water Pollution Control Act of 1956, Congressman John A. Blatnik of Minnesota, Chairman of the House Subcommittee on Rivers and Harbors of the Committee of Public Works said "Because it was evident that the crux of the national pollution problem is in the lag in construction of waste treatment works, I added Section 6 which provides for direct Federal grants to assist municipalities in the construction of sewage disposal facilities."

In reporting on H.R. 9540‡, the House Committee on Public Works stated: "On the basis of testimony and evidence presented during the hearings on this bill, the majority of the committee believes that the need for Federal financial assistance for the construction of sewage-treatment works has been clearly demonstrated. The only time the construction of sewage-treatment works kept pace with the need for such construction was during the period 1933 to 1939 when Federal funds were made available through such programs as the Public Works Administration and the Works Progress Administration. Before that and since then construction has lagged until today there is a backlog of needed treatment works totalling about $2 billion.

It was apparent that the majority of the Congress agreed with the Committee for on June 28, 1956, the bill containing Section 6 was passed. On approval by the President on July 9, it became Public Law 660. On July 31 the Congress passed the 2d Supplemental Appropriation Act which appropriated for fiscal year 1957 the full $50 million authorized.

In contrast to the public works programs of the 1930's, when financial assistance for sewage treatment plant construction was used to stimulate employment, the new construction grants represent one phase of financial aid in the Federal program and are provided as an incentive to municipalities to undertake the needed projects. To quote again from the Report 2190 of the House Committee on Public Works on H.R. 9540: "Federal financial aid for construction as provided in this bill will serve to accelerate local programs of treatment works construction by providing an incentive to take action now to clean up the waters of this country."

Administrative Machinery

Approval by the President of the Federal Water Pollution Control Act on July 9, 1956, placed on the Public Health Service and the State water pollution control agencies a heavy responsibility to set up effective and efficient administrative machinery as expeditiously as possible. From the beginning the decision was made to administer the Federal share of the grants program primarily from the Regional Offices of the Public Health Service, retaining in Washington only the program and policy guidance necessary.

To exchange ideas and experiences, and to help get the job of setting up the administrative machinery done, the Public Health Service held a series of regional meetings with the administrators of the State water pollution control agencies. Less than 5 months after the Act was approved, preparation of the necessary forms, regulations, policy and procedural manuals, criteria, delegations of authority and other materials had been completed.

On November 1 the Public Health Service distributed application forms to the State water pollution control agencies and was ready to receive requests for construction grants. The program could not have gotten under way so quickly and effectively without the assistance rendered by the State water pollution control agencies across the country. These State agencies have jointly administered the construction grants with the Public Health Service in accordance with their legislated responsibilities. Their cooperation has been excellent.

On December 6 announcement was made of grant offers to Higginsville, Mo., and Meridian, Miss., the first to be made under the new program. At the end of the fiscal year, June 30, 1957, a total of 1075 applications for grants had been filed by municipalities. These applications

‡A bill to extend and strengthen the Water Pollution Control Act, introduced in the 2d Session of the 84th Congress by Congressman Blatnik, which subsequently became P.L. 660, the new Federal Water Pollution Control Act.

requested grants totalling $97,889,447 to support projects having estimated construction costs totalling $677,131,972.

By June 30, 446 applications had been approved and grant offers aggregating $37,942,326 had been made in support of construction estimated to total $166,798,690. These offers indicate a stimulation of local construction in a ratio of $4.40 for each dollar of grant funds.

Effects on Construction

A question frequently asked is: "Has the construction grants program stimulated or retarded sewage treatment works construction?" There has been speculation around the country on this question, both pro and con. In this regard PUBLIC WORKS magazine recently polled the State sanitary engineers with these results: construction reported to be stimulated in 23 States and retarded in 3 States; reports from 11 States that it is too early in the program to determine its effects; and no reply from 11 States.

Up to this time the situation looks very encouraging despite a number of factors which have contributed to the first year's picture. Principally these are: (1) the "tight" money market; (2) delays in time caused by the necessity to set up State and Federal administrative machinery; (3) the lag in time between making the grant offer and the awarding of construction contracts; and (4) the delay by some municipalities anticipating a Federal grant.

Because of the time required for setting up the procedures for administering the grants program, no grants could be offered until December 1956. The most reliable period for comparing contract awards at this time is probably the first 6 months of each calendar year. On the basis of these periods the contract awards picture dollar-wise for the last 6 years is as follows:

First Half Calendar Year	Awards in $ millions (Actual)	(1955 dollars)
1952	71	83
1953	114	128
1954	102	110
1955	108	108
1956	222	214
1957	167	155

The figures given for 1956 require some analysis. Included are five contracts for $78 million let during a two-week period in January by the Allegheny County (Pennsylvania) Sewerage Authority. Projects of this magnitude come along only once every 10 to 20 years and their inclusion in any year-to-year analysis gives a distorted picture unless some reasonable qualification is made. If an average project is substituted for the Allegheny project it can be seen that contract awards for the first half of 1957 were substantially higher than for any comparable period of record.

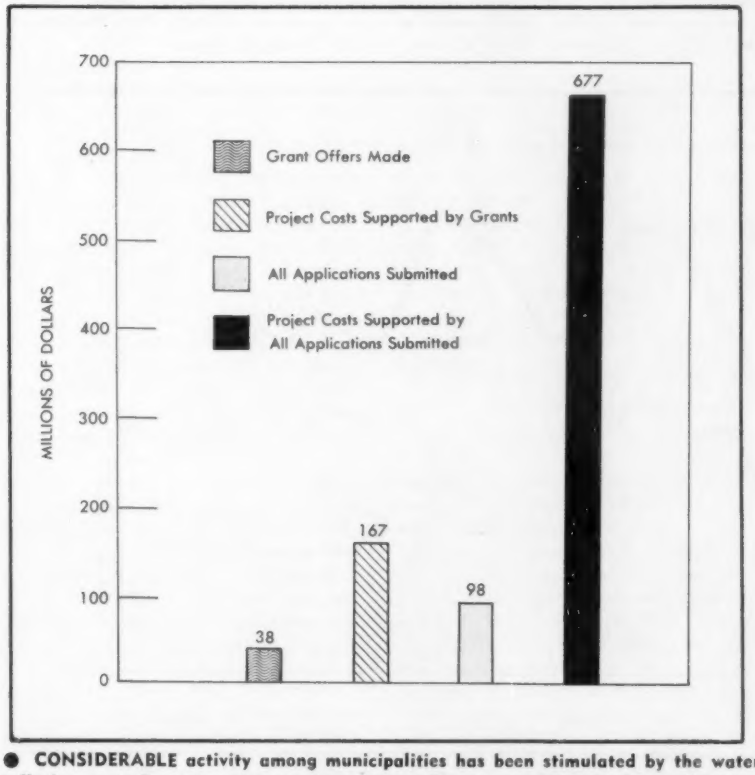
The 1957 figures also bear analysis. The total of $167 million is made up of $20 million in contracts for projects receiving assistance under the grants program and $147 million in contracts for projects being constructed outside of the grants program. The $147 million figure would seem to indicate that the grant program is not holding up sewage treatment plant construction nationally, although it is reported to be doing so in certain areas.

On June 30, contracts had been awarded for construction of 141 of the grant projects, four of which had been completed. It is expected that nearly all of the contracts for the estimated $166.7 million in construction to be supported by FY 1957 grants will be awarded by the end of 1957.

The "Tight" Money Market

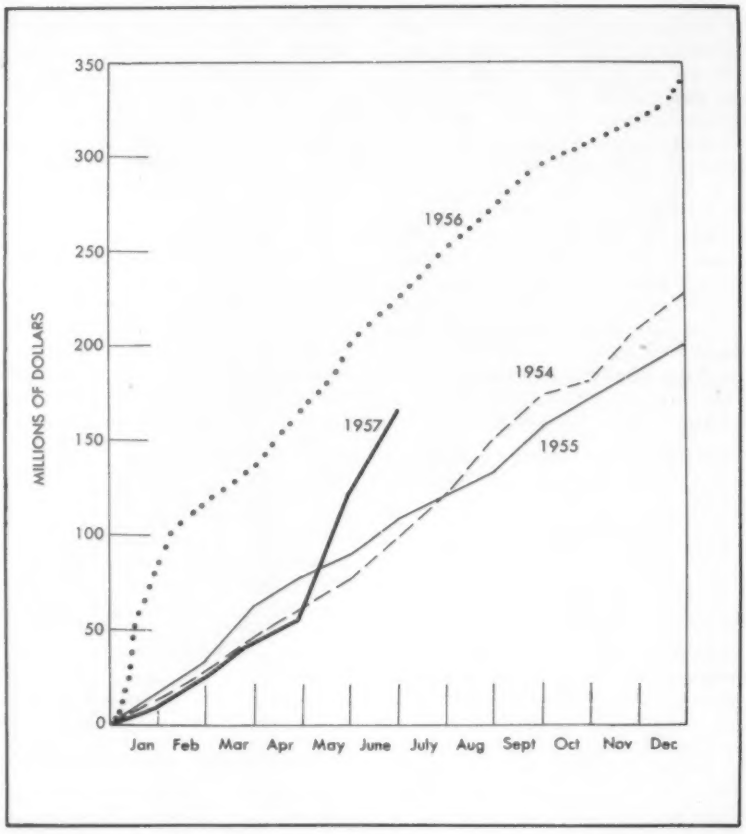
Probably the factor that has had the greatest adverse effect on the volume of contract awards for municipal sewage plant construction has been the tight money market. At the present time the net proceeds realized from the sale of municipal bonds are at the lowest level since 1935. A principal amount of $1,165,000 is required to raise $1,000,000 in today's market whereas in 1946 only $830,000 in principal was required to raise $1,000,000§. The present high interest rate has caused many communities to be reluctant to enter the bond market. Also, bonds for sewerage works have never been an attractive investment, especially those of smaller municipalities, with the result that in a tight money market, they become even less attractive and frequently remain unsold.

Although far from complete, there is evidence that the negative effect of the present unfavorable bond market on sewage plant construction has been offset to a significant degree by the stimulating effect of the construction grants program. A number of the State water pollution control administrators have reported that many of the projects which received priorities this year could not have been placed under contract



● **CONSIDERABLE activity among municipalities has been stimulated by the water pollution control construction grants program. Shown are data on the applications filed and processed and the estimated construction costs involved in the projects.**

§Based on a survey of the sale of high-grade, 2½% interest municipal bonds during the period 1926-1957, using the Bond Buyer Index.



● **CONTRACT AWARDS for municipal sewage treatment works (cumulative) for the period 1954—June 1957. All values shown are in actual dollars. These amounts include costs for interceptors and outfalls but not for collecting sewer systems.**

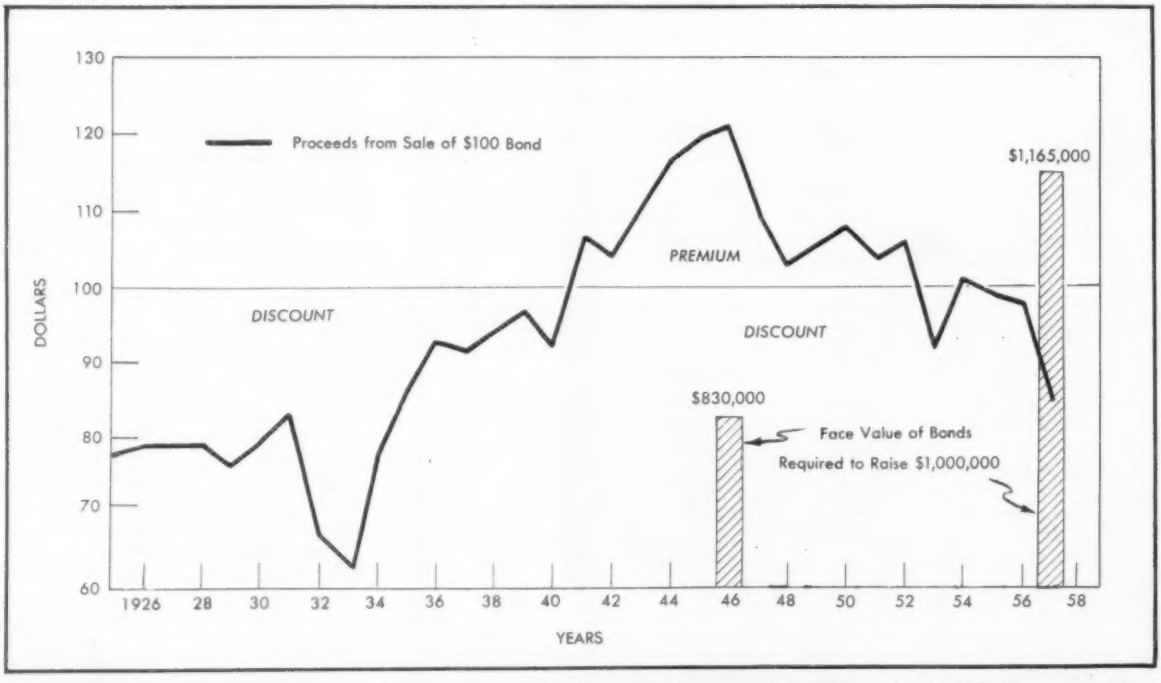
without the assistance of the construction grants. Included in the project lists for which priorities have been given are many municipalities that have delayed construction for years for one reason or another. These are now going forward under the stimulus of the grants program.

The Future

By the end of fiscal year 1957 the construction grants program had passed from the "tooling up" phase into the construction and program evaluation phases. Effective procedures have been developed for carrying out State and Federal responsibilities and close coordination has been achieved between the State water pollution control agencies and Regional Offices of the Public Health Service. During the second year of the grant program it should be possible to process applications much more effectively and the delay between grant offers and contract awards should be reduced.

For making grants for construction of sewage treatment works in fiscal year 1958 the Congress has appropriated $45 million.

There are indications that the sharp decline in the municipal bond market may have been arrested. This should ease the problem of financing sewage treatment construction and should cause further stimulation of such construction by the grant program.



● **THIS SHOWS the effect of interest charges on municipal financing for the period 1925 to June 1957. The values shown are based on twenty high grade municipal bonds with a 2½% rate and 20-year maturity, using the Bond Buyer Index.**

● CAST IRON pipe in foreground is ready for installation. Gar Wood backhoe, a crane and abutments for new bridges approaches in the background.

UTILITY CHANGES NEEDED *for* CHICAGO Skyway Toll Bridge

DEWEY JOHNSON,

Research Engineer,

Cast Iron Pipe Research Association

THE CALUMET Skyway Toll Bridge will provide a direct connection between the west end of the Indiana Toll Road and the business section of Chicago; this bridge and its long approach will connect with the Superhighway System of the City and with many of the north and south boulevards leading to the downtown Loop business area. The bridge will speed up and facilitate traffic movements between the industrial area of Gary, East Chicago, Whiting, Northern Indiana, and the center of Chicago. It will provide a direct route for automobile traffic through a restricted corridor at the south end of Lake Michigan where delays have been common due to narrow streets, railroad yards, stop signs and swing bridges, as well as traffic lights. During the summer months when the ore shipments are at their peak, the drawbridges across the Calumet River average opening 29 times per day with 3.8 minutes delay with each opening. This piles up surface traffic for blocks.

The overall length of the bridge and its elevated approaches is 7¾ miles. There will be three 12-foot traffic lanes in each direction separated by an elevated median strip. The bridge will have a clearance of 125 feet above the river level or Chicago City datum and will be of three-span cantilever type. The elevated approaches will have a minimum of 14 feet clearance above all streets and railroad crossings. The traffic from this new Skyway Toll Bridge leading into Chicago will be diverted principally to the Outer Drive through an exit at Stony Island Avenue. This will provide an easy access to a 16 mile stretch of excellent north and south bound boulevards leading along the front of Lake Michigan, designed for a 45-mile speed limit; and many other outlets will be provided. The plaza for collecting all tolls will be located between 87th and 89th Streets.

The Skyway will be operated as a self supporting utility paying all of the interest, maintenance, and sinking fund requirements from the revenue received by the users of the highway. No tax money is involved. The original bonds for the construction of the project, amounting to $88 million, were sold in 1955. Later, supplementary bond issue of $13 million was sold. The total cost of the project will be $101 million.

The entire toll bridge and its approaches are being designed for a safe operating speed of 60 miles per hour with entrance and exit ramps designed for speeds of 45 miles per hour. All of the highway will be illuminated with mercury vapor lighting. The pavement shoulders will be 11 feet in width and will be paved with bituminous material. The pavement proper will be 13 inches, consisting of 8 inches of water bound macadam and a surface binder course of hot asphaltic concrete 5 inches thick designed for a concentrated wheel load of 18,000 pounds. The floors of the bridges and other structures will be paved with bituminous concrete 2 ins. thick.

The construction of this project required the purchase or clearance of 636 parcels of right-of-way located in a metropolitan area. The original estimated cost of this right-of-way and property damages was $16,800,000. This estimate has since been reduced to $13,225,000 by the adoption of certain changes of design and location of outlets. The cost of the right-of-way was reduced but the cost of the approaches was increased. However, valuable time was saved. Today 630 parcels of real estate have been procured and the other 6 parcels are being negotiated.

Water Distribution Changes

Many changes were required in the water distribution system all

● **INSTALLATION of 36-inch cast iron main in 95th St., near Jeffrey. Hydrant lead is shown at the left. This is typical of major changes required for utilities.**

along the route, extending from State Street, southeast to the Indiana State Line. The two major construction projects consisted in the removal of 1430 feet of 36-in. cast iron transmission main between State Street and Indiana Avenue, and the relaying of a new main of equivalent length to serve the area. The second major project consisted in the removal of 1104 feet of 36-in. concrete water supply main between Kingston Avenue and Colfax Avenue and the replacement of this with a 36-in. mechanical joint cast iron main. In this area a major change of all sub-surface utilities was required to accommodate the provision of sufficient space for the toll collection plaza.

The construction work in the relocation of the 36-in. main at State Street and Indiana involved a very complicated re-arrangement of pipes, because at this point on South State Street, there are eight utility conduits in the street which had to be either passed under or over in the making of the new connection and extending the main in its new location. There was a CTA duct system, a 30-in. water main, 6-in. gas main, 8-in. Commonwealth Edison duct, a 24-in. sewer, a 24-in. gas main, an 8-in. water main and a 6-in. gas main. A "side connection" was made between the 30-in. water main on State Street and the new 36-in. main being installed.

All along the route practically the entire water system adjacent to the north boundary line of the right-of-way had to be abandoned and replaced with new distribution mains along the south boundary or on adjacent streets. Between 86th Street and Clyde Avenue it was necessary to abandon the old main and install 1700 feet of new 8-in. main in the sidewalk space. This paralleled a large high school playground. At almost every street intersection the Skyway required the removal and replacing of 100 to 200 feet of distribution piping and associated fire hydrants. The work could not be performed as a straight construction job but was and still is a piece-meal activity taking place from section to section as the various large contractors complete certain phases of the major Skyway program.

At the various traffic inlets and outlets to the Skyway, the smaller distribution mains had to be removed from the streets and at these locations two new mains were installed, usually a 6-in. main on one side of the street for the service connections and either an 8-in. or 12-in. main on the other side of the street to accommodate both the fire hydrants and the service connections. For many years, it has been the policy of the city to install two mains on all wide streets and boulevards.

All of the water mains were removed and replaced by the water department employees as they do not contract this type of work. The cast iron pipe was taken from city

(*Continued on page* 188)

● **WORKMEN connecting 36-inch cast iron main to old line at edge of ROW.**

● **EIGHT utility conduits had to be passed over or under at State & Indiana.**

Portable Drill Speeds Work on 12,000 POST HOLES

● **ENTRANCE to the Massachusetts Turnpike near Worcester showing some of the completed fencing. Chain link fence totalled 20,000 ft., stock fence 100,000 ft.**

USING A COMPARATIVELY new type of portable rock drill, the Anchor Fence Division of Anchor Post Products, Inc., is about to complete the drilling of post holes on a ten-mile stretch of the Massachusetts Turnpike. The fencing contract, undertaken by Anchor Fence Division under sub-contract to Gilbane Building Company, covered approximately 100,000 feet of stock fence, 20,000 feet of chain link fence and 100,000 feet of guard rail all near Worcester, Massachusetts.

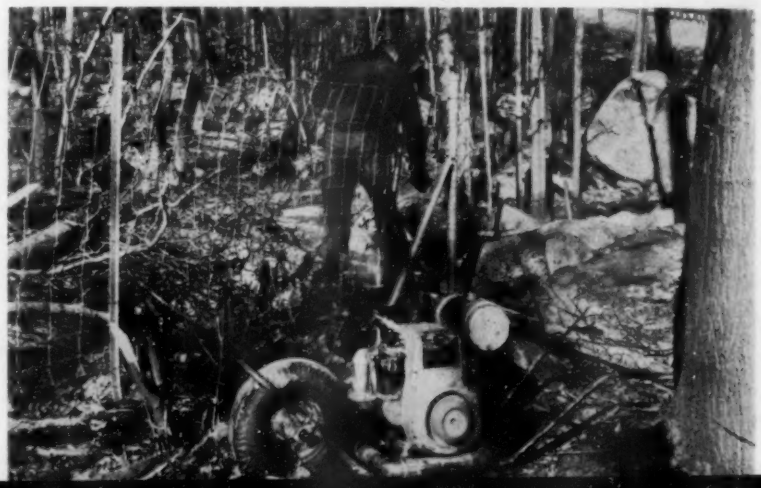
The turnpike right-of-way is 300 feet wide. The specifications called for chain link fence on the right-of-way boundary in the vicinity of high rock cuts and in settled areas and stock fence for other sections. Granite boundary markers were required at intervals of not more than 1000 feet on the straightaway and at all angle points, with steel pin markers (inserted in drilled holes) wherever rock occurred. Fence posts are spaced 10 feet apart for chain link and 12 feet apart for stock fence. Altogether the boundary fencing involved more than 11,600 post holes and some 250 boundary marker holes.

Approximately ten percent of the post holes—amounting to some 1200 holes—were in solid rock. Specifications called for sinking the posts to a depth of three feet. Faced with the problem of drilling holes in hard rock in locations that were difficult of access (often on top of 50-foot high rock cuts and 150 feet from the turnpike center line), Anchor Fence Division used a Pinazza portable rock drill with wheelbarrow mounting. This unit, which requires no compressor, can be transported to the job in the rear of a station wagon or light pick-up truck. It can be unloaded by two men and wheeled or carried to the location of the hole to be drilled.

The posts used for chain link fence on the Massachusetts Turnpike job were 1⅞-inch H-beam sections and a 2½-inch four-point bit was used for drilling these holes. A 1¾-inch bit was used for the stock fence post holes to accommodate 1½-inch T-section posts. Boundary markers in solid rock consisted of 1½-inch diameter steel pins, for which a 1¾-inch hole was drilled to a depth of 1½ feet. A six-man crew handled the boundary fence erection job.

The Pinazza P70 portable rock drill used on this job, was built by Societa Brevetti Pinazza, Milan, Italy, and was supplied by Pitnam Industrial Products Company, New York, N. Y., who imported the drills and accessory items from Italy, assembling the units with American made gasoline engines. A complete set, as used by Anchor Fence, consists of a power unit, flexible shaft and drilling hammer. The power unit comprises a standard American made 5-hp gasoline engine, coupled through a rubber centrifugal clutch to a rotary blower which generates air to clear the drill hole. The power unit assembly, weighing less than 200 lbs., can be supplied with either a wheelbarrow mounting, as used on the Massachusetts Turnpike, or a carry-handle mounting. The drilling hammer, weighing approximately 50 lbs., is designed for drilling a 1½-inch hole to depths up to 16 ft.

The Anchor Fence contract was carried out under the supervision of J. D. Jasper, field superintendent. R. R. Brannan, Vice President in charge of sales, Anchor Post Products Inc., Baltimore, had overall responsibility for the fencing contract. Other fencing contracts by Anchor Post Products Inc., have included: all the fencing on the West Virginia Turnpike; all of the chain link fence on the New Jersey Turnpike; approximately 120 miles of fencing on the Ohio Turnpike; 80 miles of fencing on the Indiana Toll Road; about 50 miles of deer fencing on the New York Thruway; and sections of the Kansas Turnpike.



● **DRILLING hole in rock for setting a boundary pin along the turnpike. Drill is driven by flexible shaft from engine.**

● **INADEQUATE** lighting was recognized as a major barrier to growth of the business section of Gulfport. This is how a principal street looked before installing the new street lights.

● **FLUORESCENT** lights are shown in photo taken from same point as one at left. Sales are better and crimes and accidents reportedly have been reduced since installation of the lights.

A BUSINESS MINDED CITY *WANTED* GOOD STREET LIGHTS

GUY BROWNING ARTHUR

GULFPORT, Miss., midway between New Orleans and Mobile, is a business-minded city in the middle of the Gulf Coast Playground. Elsewhere along this coast the water front is taken up by clubs, bars and restaurants catering to tourists and vacationers. Here the dominant feature is a rapidly expanding port for commerce with South American and Caribbean countries, soon to be developed by the state as its salt-water shipping outlet. The business section is "uptown," away from the water front, and the 30,000 population of a few years ago is pushing farther and farther into the back country in new subdivisions.

Comparatively dim street lighting was recognized as the major barrier to the methodical growth that is being planned. Haste is being made slowly, testing every proposal thoroughly to be sure it will be in step with tomorrow, and lighting was the first project. To make Gulfport the seaport of the state, the promoters contended, the business section should look the part. It should be the show window.

Mayor R. B. Meadows, Jr., led in the promotion of a modern system that could be expanded and extended as the city grows. The group started with the slogan: "Business follows the light, and a well lighted town is a good town to live in." They spread the idea that taxpayers pay for safe lighting whether they get it or not, because the cost of accidents and crime in a poorly lighted city is higher than the cost of good lighting.

Five yard sticks for measuring any new system of lighting were established: Safety, quality of light, comfort of seeing, color of lighting, and distribution to produce a "white way" effect. The Mississippi Power Company, which operated the old system, was the technical advisor on which the group leaned for research and recommendations.

Trial Installations

It was agreed that no system would be chosen until it was tested on the street. A number of systems were investigated and appraised for their likely fitness, and after much study three of these were selected for street trials. Mercury vapor units were installed in one block, 10,000 lumen incandescent lamps in the next block, and 21,000 lumen fluorescent luminaires were mounted in the third block.

The tests were advertised to the public, inviting every citizen to observe and compare for himself. All three blocks were lighted under the same conditions, and kept in service through the usual hours. They were checked, cost against cost, and effect against effect. Full recognition was given to opinion, along with technical determinations.

Comparison with the old bowl-type luminaires mounted close to poles on the other streets naturally impressed the public. Everyone could see that their light did not spread evenly or very far, and that the shadows which had seemed inescapable in the former system were distinct disadvantages. The main streets were far from looking like a "white way," and the alleys were dark.

It was generally agreed that it was an effective comparison, and impelling. It clinched the proposal to dress Gulfport up for its impending business boom. The promotion group went into session to consider all opinions of the three tested systems on the basis of the five yard sticks which had been established. Cost figures and technical determinations made by the Mississippi Power Company were given proper weight.

The choice had to be made with the old system, and its cost, as the starting point. At that time there

were 108 bowl-type luminaires rated at 6,000 to 10,000 lumens, mounted on short brackets close to wooden poles. The spacing was pretty far apart. There was little or no lighting in alleys in the downtown area. In residential sections the lighting dimmed out to very thin coverage.

It is characteristic that the decision was not reached quickly, in spite of the growing pressure for a change. In the end the group recommended to the city commissioners that the fluorescent system be adopted.

Accordingly the Mississippi Power Company was directed to begin immediately to install 109 units, GE Form 406-S, 21,000 lumen, four-tube luminaires on creosoted wood-end poles spaced about 110 feet apart. The lamps were to be mounted on extensible brackets, 25 feet above the pavement, and the mounting was to bear a uniform relation to the curb line.

Some of the units have only two tubes in the beginning, but the other two can be installed as needed. All the system, the control circuits, lamps and equipment, is owned and operated by the power company, and the increased cost to the city is estimated at $600 a month. Taxes will not be raised to pay the increased cost; the average taxpayer has a modern lighting system free. More than that, he has an added gain in the elimination of the costs and bad effects of poor lighting.

The group of prominent men who promoted the lighting project as the first step in their planning have an intense interest in the overall effect for the present, and still more in its effect on extension of the city and new business. With the same care they exhibited in choosing the new system, they evaluate it. They are looking ahead to a commercial center with more than twice the present population. This means more banks and business houses down to the water front, and the projection of residential areas far to the north. How will the new lighting system serve this growth? They are inclined to be soberly critical.

One well-supported conclusion is that the people are buying more. There are more people on the streets, especially in the evening. There are more in the stores during the day, and far more than formerly when the stores remain open at night. Observers see more window shopping, and more merchants are lighting their windows in the evening to cash in on this trend. Store fronts are taking on a higher value, which will spur improvement and modernization.

Fewer Crimes and Accidents

There is a marked reduction in mischievous and malicious vandalism. The alleys are now well lighted, and there are fewer shadows to cover the work of intending burglars. Breaking into cars has decreased on the newly lighted streets. Petty thievery is at a new low, and purse snatching is becoming rare. The police say they are aided beyond their expectations by the better lighting.

With the old system there was an accident on the streets every night. These have been reduced by about 65 percent, and it is expected that they will become still less frequent as drivers and pedestrians get accustomed to the brilliantly lighted streets and cross walks. Since Gulfport is singularly free of traffic lights and rigid regulations, this is a very important effect. It shows that the public can get along very well on its own, if it can see where it is going.

This fluorescent system is said to be the second largest in the Southeast. It is paying off in general satisfaction. Lighting efficiency has been increased 250 percent by measurement. Each luminaire gives off approximately ten times the light of the former bow-type units, and the lighting is uniform. It is possible to read a newspaper at night anywhere on the main streets.

As in all other cities shifting to better lighting systems, the public wants the new lighting extended. The two-tube luminaires will be gradually intensified by adding the other two tubes as the demand develops. Business concerns on streets not now lighted with the new fluorescent units are already asking for extensions. And residential areas and outlying shopping centers will get higher intensities in present units, progressing to fluorescent luminaires as people see how much more comfort and safety they have in better lighting.

● **LUMINAIRES are mounted on wooden poles spaced at 110 ft., with brackets 25 ft. above the pavement. Luminaires are 21,000 lumens and mostly four-tube units.**

WATER OUTPUT DOUBLED with DIESEL BOOSTER

A NEW BOOSTER system, featuring a 1.5-mg storage tank and a 5500-gpm Fairbanks-Morse diesel-driven pump, has more than doubled the peak pumping capacity of the West Hempstead-Hempstead Gardens, N. Y., Water District. Also included in the expansion program were a new 1200-gpm well, an 800-gpm motor-driven booster pump, and new distribution pipe, valves, hydrants and fittings.

When the West Hempstead-Hempstead Gardens Water District was organized in 1926, most of the 2.7 square miles it serves in central Long Island was farm land and most of the farmers had their own wells. Recognizing the importance of providing adequate water supply and fire protection to the growing residential area, the Water District was created and a $300,000 bond issue was authorized to finance the initial construction program. Two wells were drilled, a 300,000-gal. water tower constructed, 19 miles of 6 to 12-in. mains put in and hydrants were installed at 500-ft. intervals. This brought an immediate bonus of a 50 percent cut in fire insurance rates.

In 1938, a 750,000-gal. tower was constructed, raising capacity to handle peak loads and lifting main pressure to 80 lbs. In 1946, a third well was drilled, and in 1954 two more wells were added to the system. The farms were all gone, replaced by thousands of new homes, and population was pushing up toward 30,000.

Even as the new wells went into service in 1954, the District Commissioners could see that further expansion would soon be necessary and retained the engineering firm of deBruin and King to study the problem and make recommendations. Starting with both the 750,000-gal. and the 300,000-gal. elevated tanks full in the early hours of a summer day with all five wells delivering 5200 gpm into the 750,000-gal. tank, demand was so great that the smaller tank was emptied and the level in the big tank dropped 22 ft. (of its 25-ft. head range) during peak demand periods.

The consulting engineers recommended that a sixth well be drilled; but it was recognized that the most critical need was for added capacity to deliver water to the distribution system during the relatively short period of peak demand. To accomplish this, they proposed construction of a large storage tank that could be filled during off-peak hours and a high-volume pump to deliver stored water to the consumer during peak periods. This system and expansion of the distribution lines were the main elements in the $500,000 project completed early last year.

The new storage tank, built at ground level, is 32-ft. high with a diameter of 90 ft. and a capacity of 1,500,000 gallons. To deliver the stored water to the distribution system during peak periods, the engineers provided a 12-in. Fairbanks-Morse horizontal split-case centrifugal pump rated at 5500 gpm at a total head of 210 ft. The pump is driven directly at 1200 rpm by a F-M opposed-piston diesel engine rated at 375 hp.

The District pays a high demand charge for the electricity it buys and it would have been costly to add a big motor to the peak load at a time when all the well pumps were running. Operating the oil-burning diesel for these peak hours is far more economical. Also, the diesel provides protection in the event of an interruption of electric power.

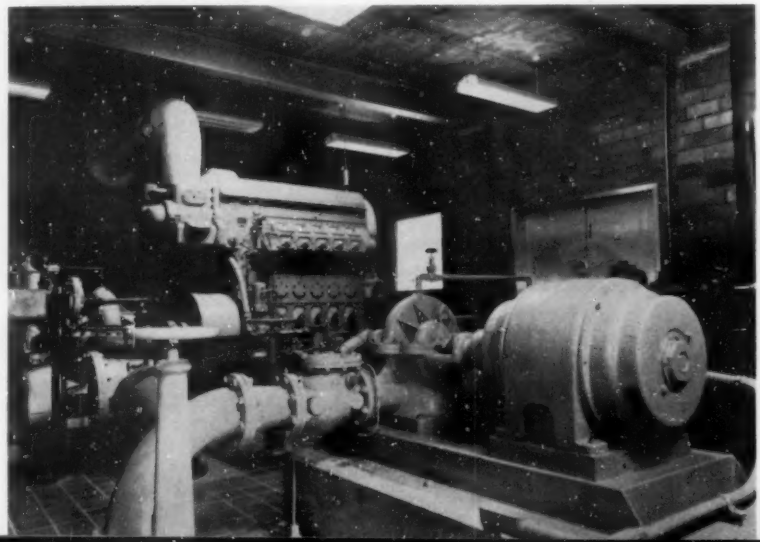
Starting with the ground storage tank full and with all six well pumps working (No. 6 discharging into the tank), the diesel driven unit permits a pumping rate of 10,700 gpm for 5 hours and 41 minutes. Added to this, of course, is the water in the two elevated tanks.

A second booster pump was provided for off-peak operation to increase the flexibility and utility of the new equipment and to permit change of water in the storage tank. The pump is a 5-in. F-M centrifugal rated at 800 gpm at 210-ft. head. This is driven by a 60-hp. F-M electric motor at 1750 rpm and the unit can be used in off-peak seasons to pump water out of storage as the No. 6 well pump sends it in, thus changing the stored water. Since the combined horsepower of this small booster pump and the low-pressure No. 6 well pump motors is no greater than the horsepower of one high-pressure well pump motor, the booster and No. 6 can be used in place of one of the other wells without increasing the demand charge for electric power. Also, piping is arranged so that water from the No. 6 well can flow directly to the booster pump, permitting the use of the new well when the storage tank is out of service.

The Water District is managed by three elected commissioners: Chairman Walter Hillenbrand, Secretary Miles Sullivan and Treasurer Louis Schuttert. Operations are directed by Superintendent Fred R. Van Wickler who has had an important part in the major expansion program.

Output of the water district has risen from 386,871,000 gal. pumped in 1950 to 812,635,000 gal. in 1955.

● **DIESEL engine driven pump in background delivers to water distribution system during peak demand times. Motor driven pump in foreground is off-peak booster.**



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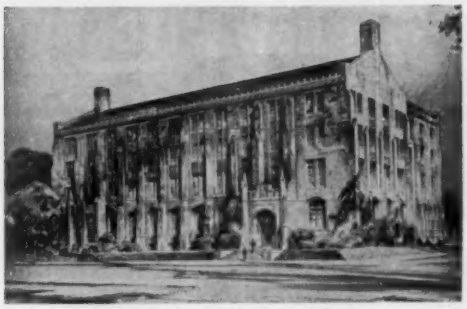

AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Newport News Official Becomes 22nd President of the APWA

Philadelphia, Pa. The election returns announced at the annual business meeting of the American Public Works Association in Philadelphia, Pa., on Monday, September 23, showed that Sol Ellenson, Director of Public Works, Newport News, Va., succeeds Robert L. Anderson, Supt. of Public Works of Winnetka, Illinois, and becomes the 22nd president of the APWA which was organized in 1937 through the merger of the American Society of Municipal Engineers and the International Association of Public Works Officials.

Ellenson, a native of Newport News, began his thirty-year career with his "home town" in 1927 as a Junior Draftsman and was named to his present post in 1948. He has held various offices in the Association and is very active in several other organizations, including the Rotary Club, Masons, Elks, American Society of Civil Engineers, and Society of American Military Engineers.

William D. Hurst, City Engineer, Winnipeg, Manitoba, was elected Vice President of the Association. Mr. Hurst has been a member of the organization's Board of Directors for the last three years and took an active part in the establishment of the Manitoba Chapter of the APWA. Charles W. Cooke, Director of Greater Hartford Flood Commission, Hartford, Connecticut, was re-elected to the Board of Directors. Three additional members were elected to serve their first terms of office as Regional Directors. They are: Robert S. Hopson, Director of Public Works, Richmond, Virginia; Edward J. Booth, City Engineer, Bismarck, North Dakota; and H. H. Hester, Street Superintendent, Fort Worth, Texas.

Hold-over members of the Board of Directors who were previously elected to office include: Frederick W. Crane, General Manager, Buffalo Sewer Authority, Buffalo, New York; Albert Wyler, Director of Streets, New Orleans, Louisiana; Roy McLeese, City Engineer, Salt Lake City, Utah; Leo Flotron, Chief Highway Engineer, Dayton, Ohio; Kenneth K. King, Director of Public Works, Phoenix, Arizona; and Jean L. Vincenz, Director of Public Works, San Diego County, Calif.

Minnesota Chapter Elects New Officers At Duluth Meeting

Duluth, Minnesota—Fifty-six officials from 28 municipalities attended the Minnesota Chapter meeting held in conjunction with the meeting of the League of Minnesota Municipalities, June 12-14, in Duluth. On the program was Lt. Col. John K. Borrowman, Chief of Operations for the North Central Division of the Army Corps of Engineers, who discussed the St. Lawrence Seaway project. Col. Borrowman stressed the fact that "benefits will not come automatically merely because better facilities exist. . . The value of any advantages of the seaway will be determined by what is done to 'sell' the products and services of the port to business and industry." He added that improvements to the Duluth Port Facility should be based upon a flexible plan that will take into consideration future conditions.

Fred R. McComb, Minneapolis, District Engineer of the Portland Cement Association, and Norman Arquette, State Paving Engineer, discussed the new state-wide highway program.

Chapter officers elected for 1957-58 are: President, P. Theodore Olsson, City Engineer, Faribault, Minn.; Vice President, Erwin Hensch, City Engineer, Fergus Falls; and Secretary-Treasurer, Graydon R. Boeck, City Engineer, Robbinsdale.

Murray Elected President of Washington State Chapter

Bellingham, Washington—A meeting of the Washington State Chapter took place in Bellingham with forty-seven members and guests in attendance. An election of officers was held naming Chester E. Murray, City Engineer of Wenatchee, President. Roy W. Morse, City Engineer, Seattle, was elected Vice President; and Chester L. Waggener, City Engineer of Moses Lake, was named Secretary-Treasurer. Also serving on the Board as directors are: William A. Trezona, Superintendent of Refuse Collection, Spokane; Oscar E. Olson, City Engineer, Centralia; L. P. Staman, Director of Public Works, Tacoma; and P. N. Royal, Principal Engineer, Seattle.

The technical program included a report of the Standardization Committee by Myron D. Calkins, Chairman, City Engineer of Tacoma; a panel discussion on Refuse Collec-

OFFICERS: Sol Ellenson, Newport News, Va., *President;* Wm. D. Hurst, Winnipeg, Manitoba, Canada, *Vice President.* REGIONAL DIRECTORS: (term ending 1958) Jean L. Vincenz, San Diego, Calif.; Leo Flotron, Dayton, Ohio; Roy W. McLeese, Salt Lake City, Utah; (term ending 1959) Albert G. Wyler, New Orleans, La.; Edward J. Booth, Bismarck, N. D.; Frederick Crane, Buffalo, N. Y.; (term ending 1960) Charles W. Cooke, Hartford, Conn.; R. S. Hopson, Richmond, Va.; H. H. Hester, Fort Worth, Texas. *Immediate Past President,* Robert Anderson, Winnetka, Ill. Donald F. Herrick, *Executive Director.*

Read how FITCHBURG CHIPPER SOLVES BRUSH DISPOSAL County of Bergen, N. J.

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May 26, 1955

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Fitchburg Engineering Corp.,
Fitchburg, Massachusetts.

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I thought I would take five minutes out to inform you about the efficient work your Fitchburg Chipper is doing in Bergen County.

As you probably well know, this Department maintains 450 miles of County road, much of it in the rural area, and formerly, when cutting brush, we had to use a large dump truck and three men to load it, and we were then faced with the problem of disposing of this brush, which was a job in itself.

Since purchasing the Fitchburg Chipper we only need one or two men and a pick-up truck to haul it, and we are not faced with the problem of disposing of this roadside brush, as the wood is now chipped along the roadside to form a soil-improving mulch.

Yours very truly,

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Supervisor of Roads.

Free Booklet

Perhaps the savings in man hours and equipment mentioned by Mr. Thier in his letter may apply to your city, town or department.

For further information on how a Fitchburg Chipper can benefit your operation, send for FREE BOOKLET: *Fitchburg Chippers—Real "Brush Eaters"*. Address Dept. PW-107

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tion and Garbage Disposal led by Chester E. Murray, City Engineer of Wenatchee, another on Utility Cuts led by L. P. Staman, Director of Public Works, Tacoma; and one on Street Maintenance under the chairmanship of Chester Waggener, City Engineer, Moses Lake.

Chapter members also voted to establish two new committees—one on Storm Sewer Financing and one on Public Works Recruitment and Training Programs. An election was also held naming Roy W. Morse, City Engineer of Seattle, Local Congress Chairman for the 1959 Public Works Congress and Equipment Show scheduled to be held in Seattle, September 20 through 23, 1959.

Rogus Elected President of NY-NJ Metropolitan Chapter

Rye, N. Y.—At the Fall Meeting of the New York-New Jersey Metropolitan Chapter, the City of Rye, N.Y., headed by City Engineer Ray Murphy as meeting chairman went all-out to provide an interesting and diversified program topped off by a real old-fashioned clam bake prepared wholly by City employees. Over 400 members and guests were present at the meeting, held at Disbrow Park in Rye on September 11.

After a period for inspection of equipment and materials exhibited by dealers and manufacturers, the group left in chartered buses for a tour of Rye's 18-acre recreation center, the City's parking lots for shoppers and commuters, and construction work on local sections of the New England Thruway. This extension of the New York Thruway has a length of a little over two miles in the City of Rye. Cost will be nearly $15 million.

Following the inspection trip the group was formally welcomed by the Hon. Robert P. Hughes, Mayor of the City of Rye. A discussion on New York State Thruways featured two speakers: Conrad H. Lang, Chief Engineer of the New York State Thruway Authority, who summarized the costs and problems involved in the New England extension of the Thruway, and Frederick P. Clark, Chairman, Rye City Planning Commission, who pointed out the need for sound local planning in communities affected by thruway construction.

A short business meeting with Chapter President H. P. Fredericks presiding included election of a new slate of officers. Casimir A. Rogus, Director of Engineering, New York Department of Sanitation, was named President of the chapter for the coming year. Other chapter of-

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ficers are August Zentgraf, Division Engineer, Division of Sanitation, Newark, N. J., Vice President; John Baffa, Consulting Engineer, New York City, Treasurer; and Elroy Spitzer, Engineering Editor, "The American City," Secretary; with Floyd F. Wilcox, Commissioner of Public Works, Lynbrook, N. Y. and Arthur Brokaw, City Engineer, East Orange, N. J., as Board Members.

Panel Discusses Road Materials At Maine Chapter Meeting

Rockland, Maine — Fifty-five members and guests attended the second regular meeting of the Maine Chapter held at the Thorndike Hotel in Rockland, Maine, on July 16. The all-day meeting featured a paper on "Sewage Odor Control With Ozene," by William V. Dwyer, Technical Service Department, Solvay Process Division of Allied Chemical and Dye Corporation; another by Jerry G. Haynes, Field Engineer of the Portland Cement Association on "Soil Cement in Maine" which he illustrated by showing slides of several projects in the state in various stages of construction; and a third paper by Paul Bennett, Sales Engineer of the Koppers Company, whose subject was "Working with Bituminous Materials in Maine," also illustrated with slides of many projects in construction stage.

A panel discussion on road materials followed the presentation of the three papers. Moderated by Lloyd Allen, City Manager of Rockland, the panel drew interesting audience participation, and included panel members Harold Halligan, Director of Public Works, Rockland; Millard Quimby, Town Manager, Dexter; and Roger F. Merrill, Director of Public Works, Bangor.

Following a luncheon sponsored by the Dragon Cement Company, Division of the American Marietta Company, several inspection trips were offered. Plans for the next meeting in November included the possibility of meeting jointly with the Maine Municipal Association.

• • •

Control of Weeds that are Detrimental to Health

Control of ragweed and poison ivy will be discussed in a Public Health Section during the second biennial meeting of the Weed Society of America in Memphis, Tennessee, on January 13-15, 1958. The program will provide essential and basic information to health, park, public works and highway departments and other interested state and municipal agencies on the use and effectiveness of the new herbicides in the control of weeds. Discussions will include the need for evaluation of results through pollen counts, as well as accomplishments in weed control in municipalities, along highways, in connection with agricultural crops, and along utility right-of-ways. Advances in herbicides, methods, and equipment will also be covered. Plans for the organization of a Public Health Section in the Southern Weed Control Conference will also be discussed.

• • •

Sign Shop Processes 51,950 Signs

The Toledo, O., traffic sign shop, now a unit of the Traffic Engineering Division, processed 51,950 signs in the past year. This figure includes new installations as well as repainting and repairs and installation of temporary traffic control signs. The sign shop used over 5,000 gallons of paint for 376 miles of traffic lane markings and approximately 1,400 gallons were applied at cross-walk areas.

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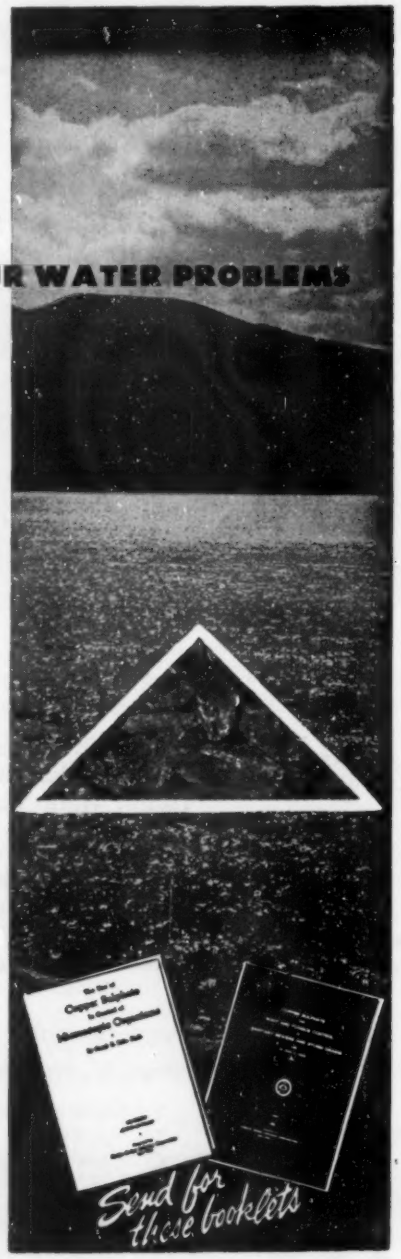
Booklets covering the subject of control of microscopic organisms and root and fungus control will be sent upon request.



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THE OPERATION OF SEWAGE TREATMENT PLANTS

(*Continued from page 127*)

ing the beds. The open or uncovered beds should generally provide 1.5 square feet of area for each person served by the plant. That is, for 10,000 persons contributing to the sewers there should be 15,000 sq. ft. Covered beds need be only two-thirds as large. The covered beds are more effective because they keep off rain and also the temperatures inside of them are normally higher, resulting in greater evaporation. Ventilators should normally be kept open to aid in ventilation.

Depth of Sludge on Beds. The depth to which wet sludge should be placed on the beds depends upon the condition or quality of the sludge primarily. The average depth in usual practice is 8 to 12 inches of wet sludge. With well digested, quick-drying sludge, greater depth is permissible. There is, in most plants, a critical depth at which best drying is accomplished and the operator should learn this as soon as possible. If a 10-inch drawing will dry in 10 days, and a 12-inch drawing in 14 days, the former is better.

A well digested sludge is perhaps the most important item in sludge bed operation, so that control of digestion tank operation affects materially sludge bed operation.

Care of Beds. After each layer of dried sludge has been removed, the bed should be raked and leveled. Some beds slope from the sludge discharge pipe to the far end, frequently at about 6 inches in 100 ft. However, the amount of slope that is desirable varies with the character of the sludge. The operator can determine this for his plant and grade the surface of his beds accordingly. Wet sludge should never be discharged on a bed containing dry or partially dried sludge. Such material should be removed before another application of sludge.

When plenty of drying bed space is available, the sludge may be left until it is quite dry. In most plants excess area is not available, and the sludge can be, and perhaps must be, removed as soon as it is dry enough to handle with a fork. It is preferable to remove the sludge at least a day or two before it is planned to apply more, to give the surface of the sand time to dry. Drying of sludge can be expedited by the use of chemicals. As little as possible of the sand should be removed with the sludge, but some will always stick to the sludge, so that there is a loss of sand with each layer of sludge removed. This requires eventual replacement of the sand. When the sand layer is reduced to 4 to 6 inches in thickness, more sand should be added. Occasionally the top layer of sand becomes clogged and interferes with drainage. When it is noted that the sludge dries slowly, the sand should be examined, and if it appears to be clogged with organic matter, the top 2 or 3 inches should be removed and replaced with clean coarse sand.

Disposing of Sludge. Sludge has fertilizer value and in some cases farmers will haul it away, but they will rarely pay for the sludge itself. In some cities, the park department uses the sludge on grass and shrubs. For such use, the sludge generally should be ground, as the lumps in unground sludge take some time to break up fine enough for direct application to a lawn. Some of the sludge produced can be used around the treatment plant for fertilizing grassy areas and shrubs. This is the best method of advertising both the value of the sludge and the quality of operation of the plant. At some plants a market has been developed for liquid sludge during certain periods of the year. It is hauled in tank trucks from the plant and sprayed on the field, later to be plowed under or worked into the ground.

Using Chemicals. Various chemicals have the property of expediting the drying of the sludge through improving its drainability. These are especially valuable where there is a lack of bed area. The ones principally used for this purpose are ferric chloride and aluminum sulfate. Ordinary applications are 5 or 6 percent by weight of the dry solids in the sludge. Computations for determining the amount of chemical needed are as follows: Assume a bed 20 ft. by 20 ft. to be covered with 12 inches of sludge having 2 percent solids and 98 percent water. Assume the weight of sludge the same as water, or 8.33 pounds per gallon or 62.5 lbs. per cubic foot.

A bed 20 x 20 contains 400 sq. ft.; and when 12 inches of sludge is drawn contains 400 cubic feet of sludge. At 62.5 pounds per cubic foot, this sludge weighs 25,000 pounds. If 2 percent of the sludge is solid matter the weight of the solids is 20% of 25,000 or 500 pounds. If 5 percent of chemical is to be applied, the amount required would be 500 x 0.05 = 25 pounds.

The chemicals are usually added as a solution just as the sludge is flowing onto the bed, as the reaction is rapid.

Winter Operation. Beds offer some difficulties in winter operations, particularly when heavy ice or snow storms, followed by freezing weather, occur after the sludge is partially dried on open beds. However, sludge may be placed on beds, particularly covered beds, in freezing weather. If frozen sludge can be removed without taking too much sand, and stockpiled, it will be found very desirable for use on lawns, after thawing and drying, as it tends to powder easily.

It is particularly important that all sludge lines, as well as any other lines carrying liquids, exposed to the elements, should be drained completely to prevent sludge from hardening in them, and also to prevent freezing in the winter.

Records of Operation. At the time the sludge is drawn a record should be made of the date, the number or designation of the bed onto which the sludge is drawn, the depth of the wet sludge and the number of cubic feet drawn. When the sludge is removed from the bed, the date and number of the bed being cleaned should be shown; the depth of the dried sludge, the length of time it has dried and the number of cubic feet or cubic yards removed; also the man hours and truck hours required for removal. When the sludge is drawn to the beds, an examination to show the solids content, the volatile solids and the pH should be made. Likewise the moisture content of the dried sludge should be determined. All these factors should be noted on the records of operation.

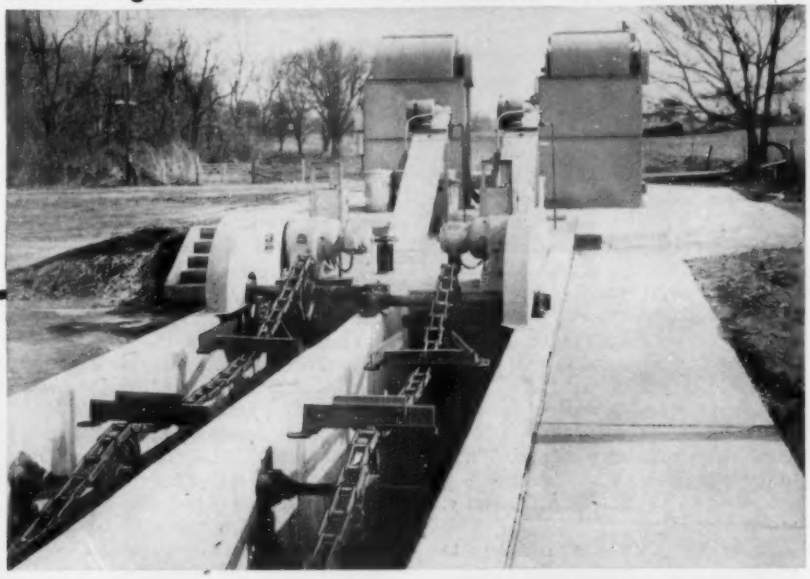
Vacuum Filters

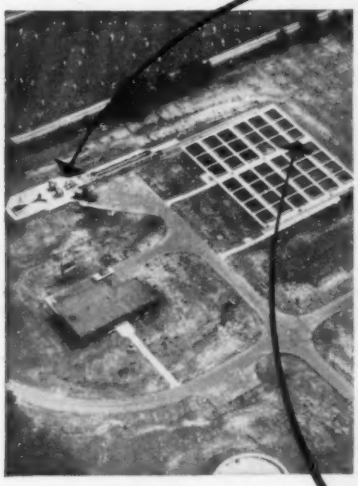
Vacuum Filters. Vacuum filters are highly suitable for rapid dewatering of sludges. They are used for either raw or digested sludges from primary or secondary treatment plants. Sludges containing 85 to 98 percent moisture are rapidly dewatered, producing a filter cake with 70 to 75 percent moisture. These filters are especially worthy of consideration in these days of high labor costs. Filtering is accomplished through a cloth or coil spring medium on a drum rotating in a container of sludge. The filter cake is removed by air pressure and dropped onto a conveyor.

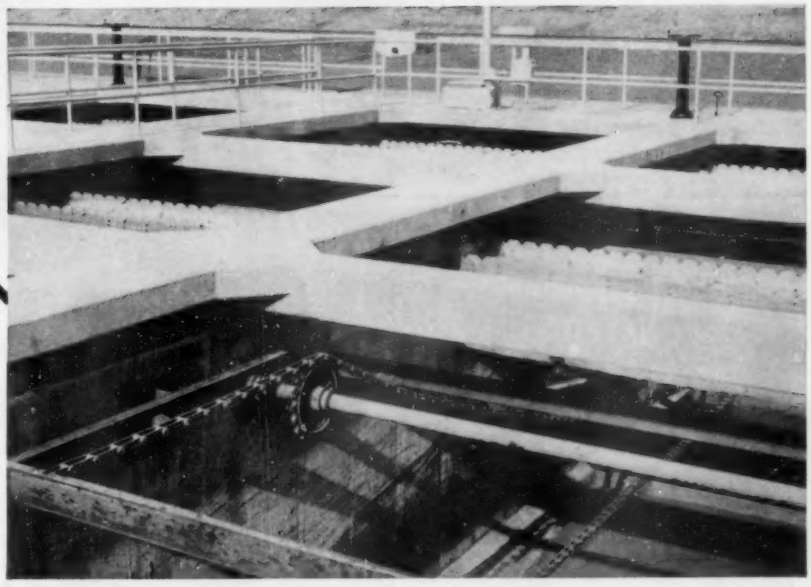
When sludge is properly conditioned, yields of 4 to 5 pounds of

See our exhibit—Federation of Sewage and Industrial Wastes Assns.—Boston, Oct. 6-10

INFLUENT enters parallel channels. Thru-Clean bar screen (background), mounted in each channel, removes trash and debris. Link-Belt roller chain drives each screen through a gearmotor. Inorganic matter such as grit, sand and gravel is removed from the sewage as it passes through the grit chambers (foreground). Each grit collector consists of a strand of 6-in. pitch combination chain with ⅜-in. steel angle flights attached every 5 ft.







EFFLUENT end of settling compartment of pre-aeration settling tanks shows Link-Belt Promal chain and redwood flights used on Link-Belt Straightline longitudinal sludge collectors. Flights, mounted every 10 feet, travel at 2 feet per minute. Flights collect sludge from both settling and pre-aeration compartments. The combination of pre-aeration and settling results in a removal of 70-80 per cent of suspended solids. Weirs at far end of compartment discharge effluent to outfall sewer to river.

How Link-Belt equipment is helping Henderson, Kentucky,

halt river pollution

COOPERATING with the Ohio River Valley Water Sanitation Commission, Henderson, Ky., has recently completed an efficient treatment plant to eliminate dumping of raw sewage into the Ohio River. Consulting engineers were J. Stephen Watkins and Robert E. Martin of Lexington and Louisville.

As in so many other municipalities, Link-Belt equipment was specified for an important share of the work. Units include Thru-Clean mechanically cleaned bar screens . . . Straightline grit collectors . . . grit washing and dewatering screens . . . Straightline longitudinal and cross sludge collectors.

This equipment is part of the broad Link-Belt line. Our sanitary engineers will work with your consultants and chemists—help you get the best in water, sewage or waste treatment.

LINK-BELT

SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville (Sydney), N.S.W.; South Africa, Springs. Representatives Throughout the World. 14,711

dry solids per sq. ft. of filter per hour are obtained. Chemicals required may range to 5 percent of ferric chloride and 10 percent or less of lime, figured on the weight of dry solids in the sludge. The moisture of vacuum filter cake will average from 70 to 75 percent. The operator must determine by trial the chemical dose most suited to the sludge with which he is working. Less chemical is required for raw than for digested sludge.

In order to be sure that the sludge is properly conditioned, it is better when starting filtration to increase the chemical dose somewhat above the normal for about a half hour and then gradually reduce the dose to a normal amount, until just the right cake is being obtained. When the proper chemical dose is obtained, the cake will be discharged cleanly, without sticking.

In small plants with adequate vacuum filter capacity, sludge dewatering may require only a part of a day, two or three times a week. One man can operate a filter. Such an installation may largely pay for itself in reduced labor costs.

Metering Devices. Weirs and float wells must be cleaned daily to prevent the accumulation of solids and grease. Weir plates should be maintained sharp and straight. When dosing chambers are used for flow measurement, particular attention must be paid to keeping these free from accumulation of solids. Parshall flumes must be kept free from grease and adhering scum and the float well flushed frequently. Venturi tubes should be cleaned 2 or 3 times a week.

Float gages should be checked monthly by lowering the liquid elevation to the crest level, at which time the pointer should be on the zero mark. If it is not, the calibrated portion of the gage should be adjusted. Indicating, recording and integrating flow instruments should be checked by dropping the liquid to the crest on Parshall flumes, or by equalizing the liquid level or pressure in float tubes or chambers in the case of venturi tubes. Unless the operator is experienced in this work, he should ask the manufacturer for instructions.

Charts should be changed at the same time every day. Records maintained should show total flow, the maximum rate of flow and the minimum rate of flow, all mgd.

Sludge Pumps. Sticks, rags or other solids may clog the valves of reciprocating sludge pumps, holding them open. On pumps which have a pressure gage on the discharge side of the pump, the fluctuation of the gage needle provides a good indication of the operation of the pump. No fluctuation indicates that the inlet valve is being held open; a greater than normal fluctuation indicates the discharge valve is not seating. Quick-opening hand-holes are provided through which obstructions are removed. Air should be kept in the air bell. Operating, lubricating and maintenance instructions provided by the manufacturer should be followed.

Sewage Pumping Stations. Centrifugal pumps are used almost exclusively in pumping sewage, normally operating at speeds of approximately 1150 rpm. Pumps are set (1) submerged in the sewage in a wet well; (2) in a dry well below the sewage level in an adjoining sump or well; or (3) above the sewage level, raising the sewage by a short suction line. The second method is generally preferable, the third undesirable.

Since the cost of pumping, where this is necessary, is usually a large item in the cost of operating the plant, special attention should be

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EASILY mounted on any short wheel base truck with 8 ft. in back of the cab, the NETCO with orange peel or clamshell bucket can be operated continuously, averaging 20 to 30 catch basins a day. Hoisting capacity up to 1500 lbs.

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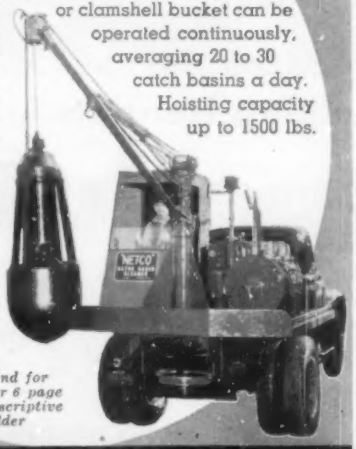

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- 1—Requires an average of 40% less wash water
- 2—Completely eliminates mud balls
- 3—Eliminates cracking or shrinking of the beds
- 4—Produces "new" filter media after short period of normal operation
- 5—Turns out purer, better tasting water
- 6—Low installation cost
- 7—Low operating cost
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FAR SUPERIOR to Sand or Quartz Media, as it Double length of Filter runs, nearly halves wash water needs; with less coating, caking, or balling.

Filters are in service more as wash water cycle shorter. Better removal of bacteria, taste, odor. Increased Filter output, better effluent. Ideal for industrial acid and Alkaline solutions. Ask any user.

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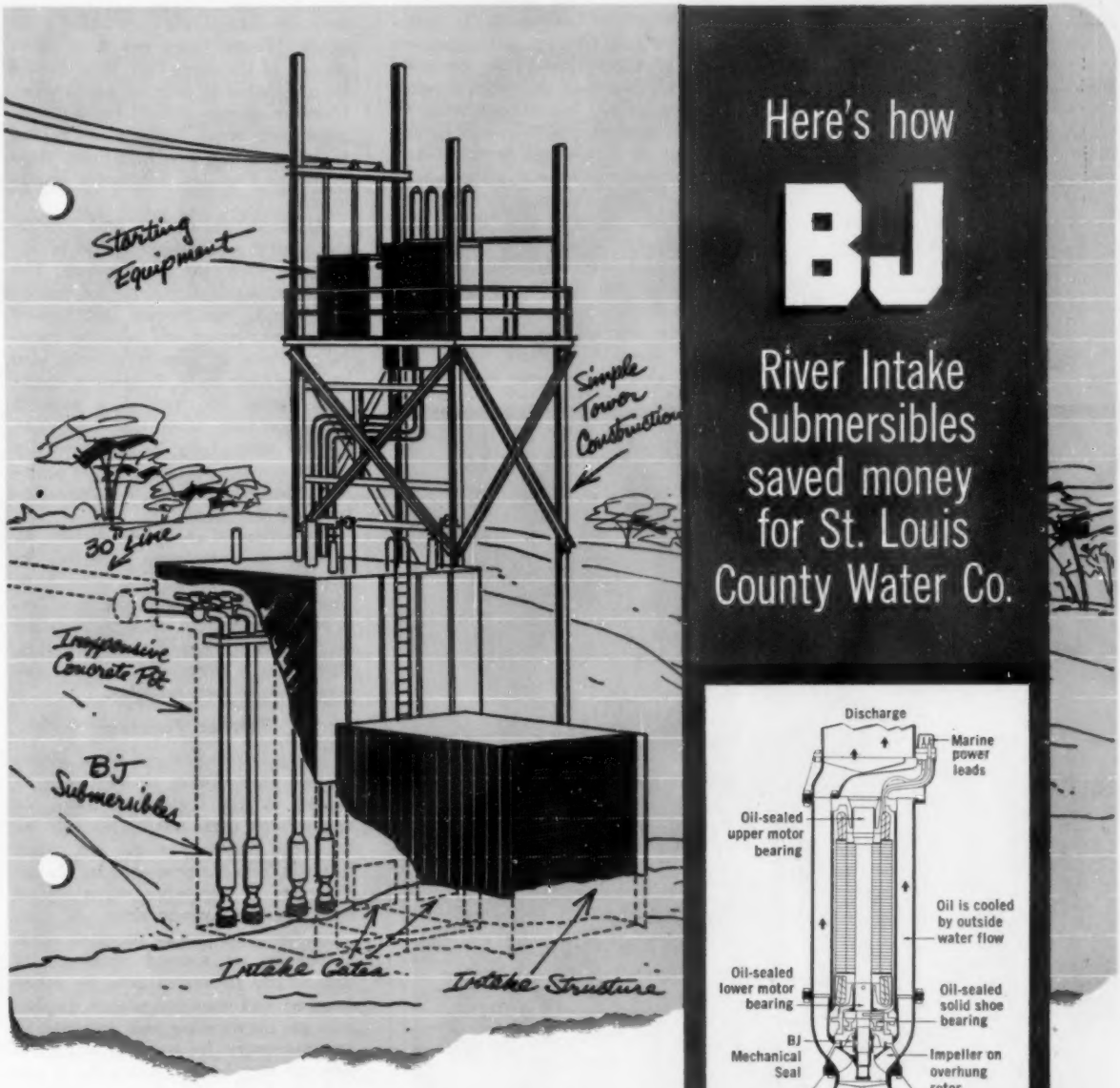
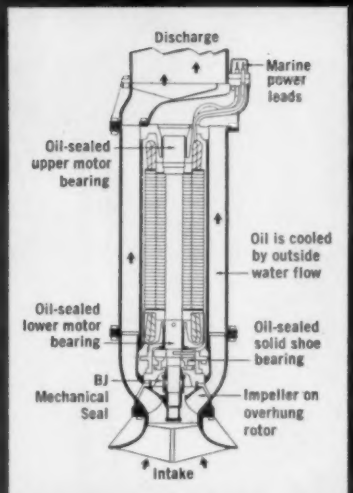


Here's how BJ River Intake Submersibles saved money for St. Louis County Water Co.



St. Louis County Water Company saved money on their South County Plant installation by using Byron Jackson river intake submersibles. Four completely submerged BJ motor-pump units eliminated the need for an expensive elevated structure to house motors above flood stage. Intake and pump structure are simple concrete pit construction. The only elevated structure is a low cost platform which holds starting equipment.

These BJ Submersibles are unaffected by flood or weather conditions... are always primed and safe from vandalism. The mechanically sealed, oil-filled motor is close-coupled above the pump with all bearings inside the motor housing. No bearings are in the pump itself. Thus no bearings are exposed to silty water. Each pump delivers 3500 GPM against a 100 foot head, and is powered by a 100 HP, 1750 RPM motor. One man, at a remote panel located in the main plant a mile and a half from the river, controls the entire operation.

No bearings in the pump!

All bearings are in the sealed, oil-filled motor.

BYRON JACKSON PUMPS

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Write for complete "Submersible Facts" file including primary, booster and river intake uses.

given to maintaining the pumps in efficient operating condition. Pumps that are partly clogged, have inlets that develop excessive friction or entrance losses, or have worn or improperly designed impellers may contribute to excessive power charges. Improperly maintained pumps may fail, which in a sewage plant is almost always a major disaster, and may create a health hazard.

Wet wells should be drawn to the minimum elevation daily, and (1) deposits removed; and (2) walls and bottom thoroughly flushed with a heavy stream of water. Grit accumulations should be removed at regular intervals. Grease accumulations in float tubes should be removed daily by flushing or other means. Screens should be cleaned daily or more frequently, as indicated by the amount of screenings accumulated, and screenings should be properly disposed of as already indicated. Water that accumulates in the dry well should be removed daily.

The pumping cycle is normally controlled by floats and sequence switches. Where pumps of different capacity are installed, the smaller pump should cut out when the larger one starts, and vice versa; both should operate only under peak loads. Where there are 2 or more pumps of the same size, they should be alternated to provide equal wear. Standby pumps should be operated once each week for a short period to insure they are in proper condition and to dry out motor windings.

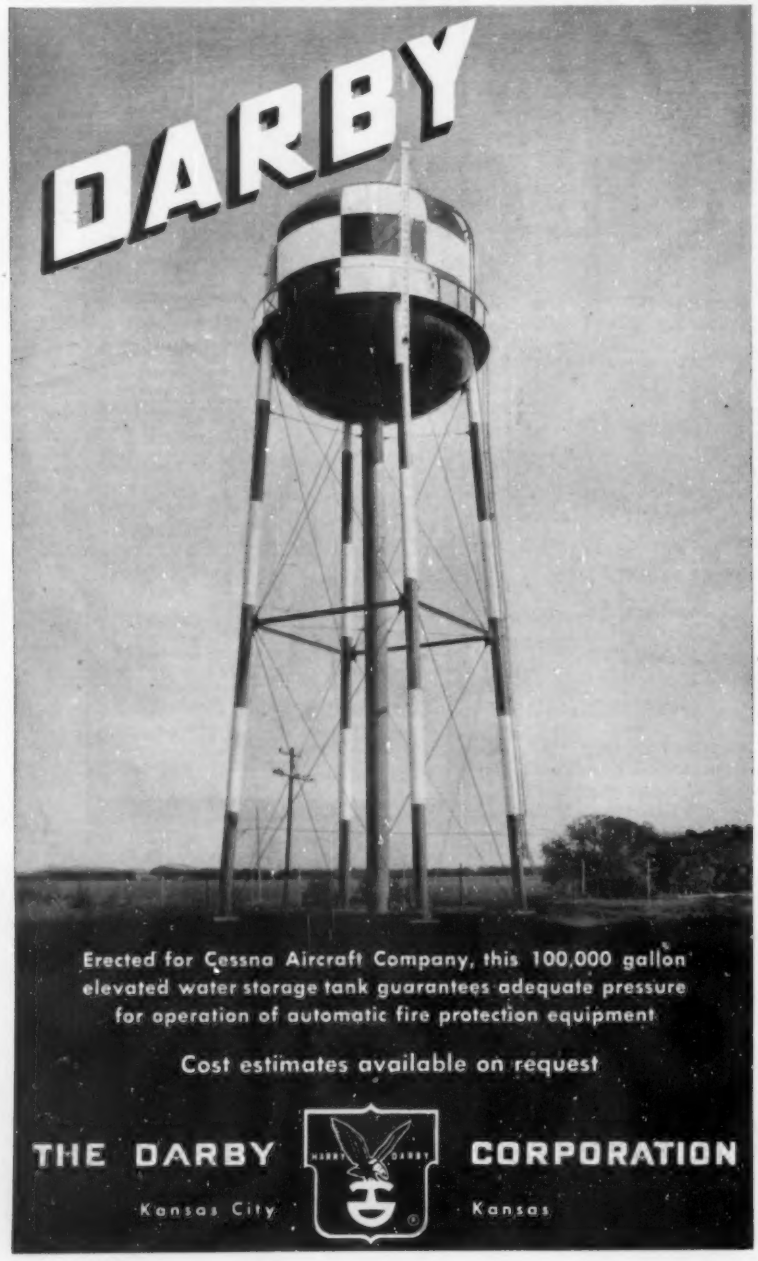
All bearings, motors and electrical control equipment should be inspected daily for overheating. The manufacturer's directions for operation and equipment lubrication should be studied and followed carefully. Packing glands should also be inspected daily. Excessive tightness should be avoided, a packing being too tight when the shaft cannot be rotated by hand, especially on the smaller pumps. Use the packing recommended by the manufacturer of the pump.

Operation of the pump briefly in reverse is sometimes effective in preventing clogging, as this tends to free material caught in the impeller. A reversing switch must be installed on the control board to permit this. Operation in reverse should not exceed one or two minutes.

Other Factors

Safety in the Sewage Plant. Some of the precautions to be taken in regard to liquid chlorine have already been mentioned. Gas poisoning and gas explosions are other hazards. The gas produced by sludge digesters is explosive when mixed with certain proportions of air. Therefore smoking or carrying open flames in or around digesters is hazardous. In pump pits or other covered and enclosed places, explosive gas may gather and precautions are necessary in entering them to prevent explosions. Also, the gases contained may be fatal to anyone who breathes them. Therefore covered tanks or pits should be well ventilated by blowing air through them before being entered; anyone entering them should fasten a rope to his body, and another man should remain outside holding the other end of the rope and ready to help. A ventilating blower should be available at every plant. Explosion-proof electric motors, switches and lights should be installed where explosion hazards may exist.

A first aid kit and a gas mask should be a part of the equipment of every plant. Be sure to note if this mask protects against chlorine and against carbon monoxide also. Individual gas masks are serviceable for protection against only a few gases. Therefore a mask designed to serve against chlorine may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Erected for Cessna Aircraft Company, this 100,000 gallon elevated water storage tank guarantees adequate pressure for operation of automatic fire protection equipment
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be of no use whatever against other gases.

Fire extinguishers of the proper type and size should be located at strategic points, and maintained in good operating condition.

It is desirable to protect tanks by railings to prevent attendants or visitors from falling into them. Aeration tanks are especially hazardous as the mixture of air and water is not nearly so buoyant as plain water. Gears and other moving parts should be screened or guarded.

Keep a set of the blueprints showing details of the plant. Some of these may be framed and hung on the walls, not so much for decoration as for ready reference and preservation. Prints handled frequently rapidly wear out. Pumping installations, pipe layouts, and similar material that is needed for more or less frequent reference can be kept under glass.

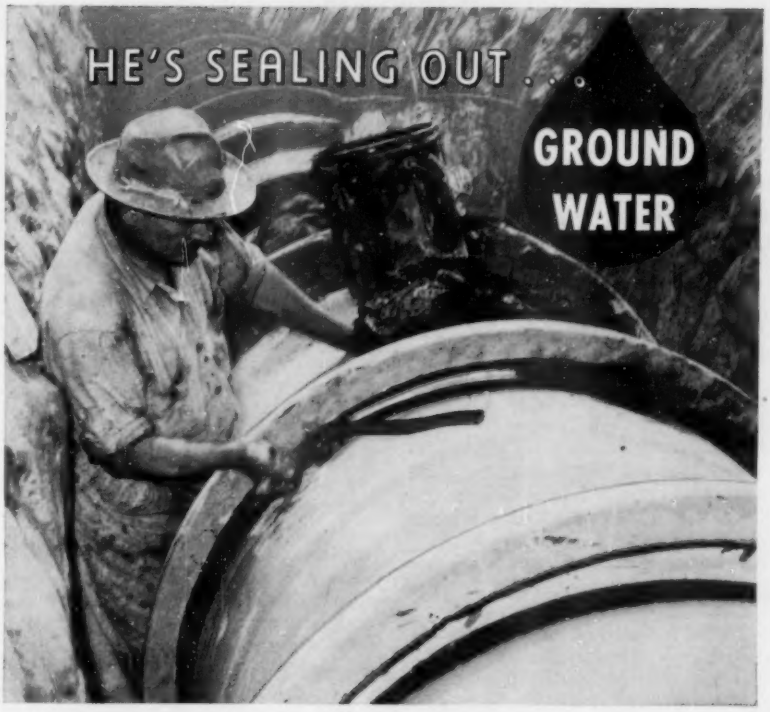
Keep your own copy of your monthly reports to the State Department of Health, and study these from time to time. Familiarity with what has been done and the results obtained are of most value in efficient operation. Written records are best, as memory is unreliable.

Plant beautification should not be neglected. Plant shrubs, flowers and grass, and keep the grounds clean, neatly mowed and trim.

A library should be maintained at every plant. This should include *Standard Methods* and at least a couple of recent texts on sewage treatment; also some of the many excellent bulletins and pamphlets issued by manufacturers serving this field. Read your technical magazines; the Sewerage Digest section of PUBLIC WORKS will keep you informed on what has been published. Join your Sewage and Industrial Wastes Works Association, or at least attend its meetings. Enroll for some of the short courses for plant operators now being given in almost every state at the State University.

The plant operator has the responsibility for operating efficiently the facilities under his supervision; and he has also two other obligations. He should record all operating data and observations that may be helpful to the community in planning future improvements or enlargements; and he should not hesitate to recommend the immediate installation of devices which will save labor, give better operating results and make his job easier.

The operator holds a key position because he is closer to the problems —and to the opportunities—than anyone else.



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3-STEP SEWER SEALING SYSTEM

To keep ground water infiltration out, and prevent sewage overload, this installation is getting Presstite's full, **watertight** treatment.

1 PRESSTITE PRIMER, painted on bells and spigots 24 hours before laying, greatly improves bond between pipe and joint sealing compound.

2 ROPAX® (shown being caulked in), a non-porous adhesive packing, provides additional joint sealing material. When packed into the bell, it forms a solid, dense seal impervious to water passage.

3 KALKTITE,® a cold-mixed, cold-applied joint sealing compound, used to fill the balance of bell. Sets up **internally** under the most adverse conditions. Forms a dense, tough, flexible seal.

WRITE for detailed catalog "3 Steps to Tighter Sewer Joints"

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PRESSTITE-KEYSTONE ENGINEERING PRODUCTS COMPANY
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PUBLIC WORKS DIGESTS

Prepared by
FRANK FORCE
Associate Editor

THE HIGHWAY AND AIRPORT DIGEST

Widening Old Narrow Bridges

A comprehensive program of bridge widening is in progress in Illinois, with 100 bridges widened in the last 3 years and 70 structures scheduled to be widened during 1957. The criteria followed for planning the widening of the bridges are as follows: (a) Check to see if the waterway opening is sufficient on existing structure; (b) structure is checked for strength in accordance with the AASHO Inventory Ratings; (c) check for physical condition; (d) no attempt has been made to widen existing steel truss spans; (e) reinforced concrete through girders are not considered adaptable for widening. On existing reinforced concrete slab-and-deck girder bridges, the old railing, rail base, and curb are removed. The superstructure is widened to the desired width by utilizing the same type of construction as the original; that is, either concrete slab or concrete girders. The abutments are widened by removing existing wing walls down to the bridge seat elevation, then constructing an extension to the main wall to the desired width and building new wing walls on new footings. All new walls and footings are tied to the old walls and footings by cinch anchor bolts and dowels. Concrete slab bridges widened with slabs cost $30.50 psf. Concrete deck girder widened with girders cost $28.40 psf. Concrete deck girder widened with prestressed beams cost $29.40 psf.

"Widening Old Narrow Bridges." By R. R. Bartelsmeyer, Chief Highway Engineer of Illinois. *Roads and Streets*, August, 1957.

Vibratory Compactors and Pneumatic Tampers

The principal application of vibratory compactors and pneumatic tampers is in the densification of granular soils and granular base courses. They have also been used successfully for the compaction of soil stabilized mixtures, cohesive soils and both hot and cold asphaltic mixtures. There are three basic types of vibratory and pneumatic tools which are used most often in highway compaction. They are flat plate vibratory compactors, vibratory rollers and pneumatic tampers. Available flat plate vibratory compactors fall in two classes—relatively small units which incorporate a single vibrating unit; and large "multiple" compactors. Vibratory rollers are smooth, steel-wheel rollers which vibrate as they roll over the material to be compacted. Pneumatic tampers are air-powered, impact-type compactors, which are intended primarily for compaction of backfill in trenches, around culverts, and in other limited areas.

"Vibratory Compactors, Pneumatic Tampers." *Modern Highways*, June 15, 1957.

Street Paving On Voluntary or Nonvoluntary Basis

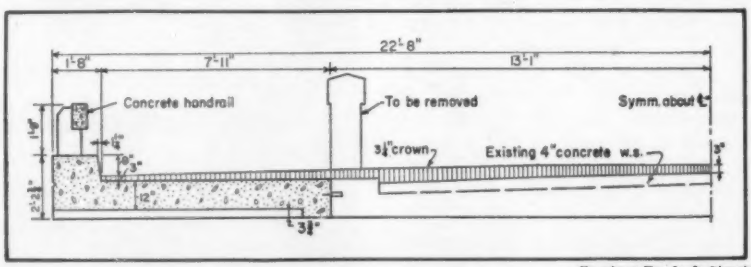
Residents in St. Cloud, Florida, may choose street paving on a voluntary basis, with the city's approval of the type of paving, grade and similar technical details. They also can petition to have the work done and the city takes care of all details. The nonvoluntary, or special assessment, method requires a petition signed by owners of at least 75 percent of the front footage of property affected. This procedure entails (1) adopting a resolution that the work will be done and publishing it in a local paper, (2) preparation of an assessment roll and publishing it once a week for two weeks in a local paper, and (3) holding a public hearing on the proposed program. All streets have a sand base paved with 6-in. sand bituminous road mix. The street is graded to grade and enough lime rock is added to increase the bearing strength of the sand to 40 psi, or better. Parking is prohibited on the street for two weeks after being built.

"Street Paving in St. Cloud, Fla." By E. Jay Smith, Mayor, St. Cloud, Fla. *The American City*, August, 1957.

Evaluating Gravel Sources For Highway Use

The purpose of this article is to describe some basic steps in the evaluation of possible gravel sources that are so important to economical road construction and maintenance. Before opening a possible source of gravel, these questions should be asked: (1) Is it near enough to current and future needs to warrant further evaluation? (2) Is access feasible? (3) Is there enough gravel? Once a pit or test hole has been opened, we are interested in these characteristics: (1) Depth of overburden; (2) Character of gravel particles; (3) Maximum gravel sizes expected; (4) Graduation of granular material; (5) Plasticity of fines; (6) Position of water table; and (7) Degree of cementation. Sampling and testing of a representative sample of material from the gravel source include a sieve analysis, quick-wash test, plastic and liquid limit tests and hand-feel evaluation.

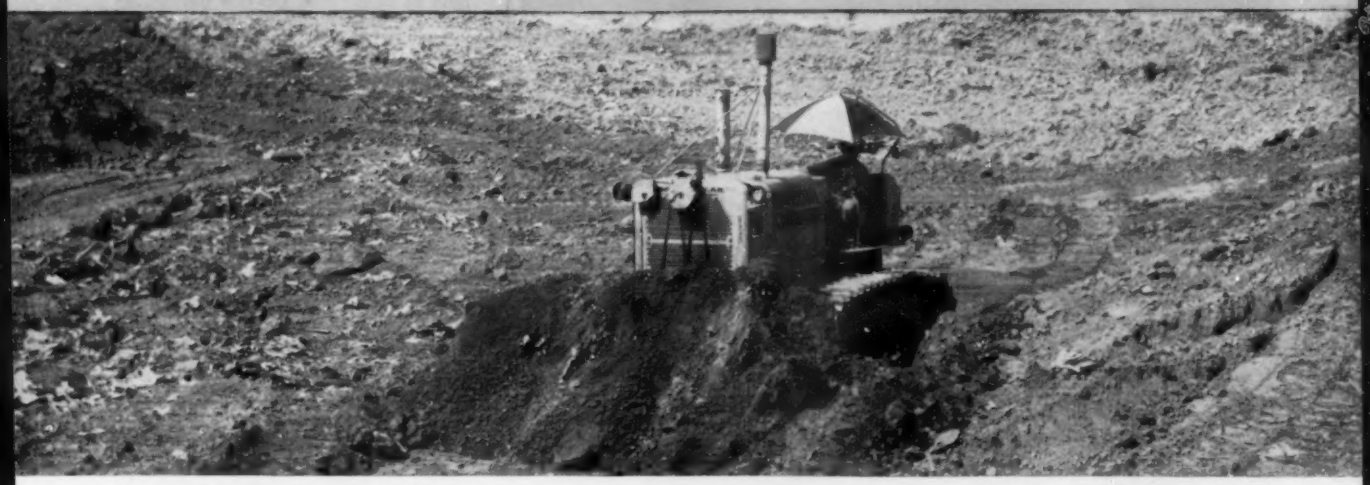
"Evaluating Gravel Sources For Highway Use." By J. W. Spencer, Highway Research and Extension Engineer, and O. K. Dart, Jr., In-



Courtesy Roads & Streets

● **BRIDGE widening job for slab deck is simplified. New concrete is doweled to old slab by means of expansion bolts. New style hand rail is shown in illustration.**

"This D9 is ideal for our operation"



On a site in Los Angeles, Cal., this rugged CAT* D9 Tractor with No. 9S Bulldozer is moving, compacting and covering rubbish on a sanitary landfill operation. The B.K.K. Co. of Los Angeles has the contract.

"This D9 is ideal for our operation," says Ben K. Kazarian, Jr., secretary of the firm. "We get good compaction from it and it is able to handle bulky material with ease. Operator's view is good and handling is easy."

Mr. Kazarian's D9 is new, but he knows he's going to get dependable service from it, year in and year out. "We've always been prejudiced toward Cat-built equipment," he explains, "because we get longer life and have less down time with it." On the same landfill operation, the B.K.K. Co. is using two Caterpillar D8 Tractors and a No. 212 Motor Grader. The tractors are handling about 3000 yards per eight-hour day.

The "good compaction" he talks about comes from the giant D9's great weight—more than 29 tons—on its extra-long-lived "water quenched" track shoes. The D9's ability to "handle bulky material with ease," as Mr. Kazarian puts it, is due to a number of features: the Turbocharged Cat Diesel Engine, which develops 320 HP at the flywheel; hydraulically boosted controls, and smooth constant power drive for cable and hydraulic controls. Available with either torque converter or exclusive oil clutch, the D9 is as easy to handle as many smaller tractors.

Let your Caterpillar Dealer *prove* to you that this "King of the Crawlers" can do more work at lower cost on *your* job.

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**NAME THE DATE...
YOUR DEALER
WILL DEMONSTRATE**

structor, Dept. of Agricultural Engineering, Cornell University. PUBLIC WORKS, September, 1957.

Toll Roads Must Be Kept Snow and Ice Free

Defrosting apparatus was installed at all the toll plazas on the Indiana Toll Road. The steel pipe defrosting grid system was embedded 3½ ins. in the pavement and is operated by a thermostat. When the pavement temperature falls below 34°, oil heated to an 80° temperature starts circulating through the pipes. The units for the 12 toll plazas were installed at an approximate cost of $531,000. A large fleet of trucks equipped with snow plows and underbody scrapers, hopper bodies and spreaders are used to handle snow and ice along the entire length of the Toll Road. Also motor graders, highlifts, travel loaders, a Gradall and a truck crane round out the equipment used. Sand, cinders, calcium chloride and sodium chloride are the abrasives and chemicals used. Five radio stations have been installed on the Toll Road for use by the Maintenance Dept. Radio and the mobile radio units play a big part in keeping the highway free of snow and ice.

"Toll Roads Must Be Kept Snow and Ice Free." By Albert J. Wedeking, Executive Director, Indiana Toll Road Commission. PUBLIC WORKS, September, 1957.

Pavement Widening Program

Phase one of Iowa's three-phase pavement-widening program on old 18 and 20-ft. wide concrete pavements is continuing this year and for at least another. This year it is being followed by phase two and phase three. Phase two is the bituminous resurfacing of the pavements widened under the first phase and phase three is the regrading of shoulders, ditches and backslopes. The widening of bridges and other structures has been another major element of the work, although it is actually part of phase one. On one particular job the following equipment was used. An Armstrong curb breaker that removes the lip curbs from the edges of the old pavement and a Blaw-Knox slip form paver adapted to the Blaw-Knox shouldering spreader. Clipper saws accompanied by a 4,000-gal. water tank to supply the water to the saws were used to cut the edges of the existing curb lips. Other equipment used included motor graders, a tractor-shovel, trench roller, compressor, concrete-widening machine, finisher, concrete vibrators, a generator, and a concrete batching plant. The State of Iowa requires the use of an impervious subgrade paper under concrete pavements. On some of the jobs a sheet of Visqueen clear plastic film was used instead of paper. A sheet of opaque white Visqueen film was used in curing and the plastic was supplied in 5 and 6-ft. widths in rolls of 3300 and 3000 feet, respectively. A central concrete mixing plant furnished the concrete.

"Iowa Starts Second Season of Pavement Widening Program." *Contractors and Engineers*, August, 1957.

Building Maintenance Into Highways

The team to design and build maintenance into the Interstate Highway System should include engineers of location, design, construction and landscape; and the team should have, as consultants, engineers with many years of maintenance experience — especially in roadside work and landscaping. Medians are generally designed with a cover of turf and, where these are in excess of 30 ft. wide, they can well include heavy plantings of trees, shrubs and ground covers. Every endeavor should be made to reduce the amount of turf to the ab-

Good Roads MACHINERY "JET" SPREADERS
for fast, efficient snow and ice control!

Ideal for sand, cinders, salt, gravel, calcium chloride, lime and sealcoating
A SIZE AND STYLE FOR EVERY NEED!

Rugged "Jet" Spreaders are job-designed to provide the speed and capacity essential for fast, efficient ice control and utility spreading on roads and streets. Even with a minimum of experience, operators can spread salt, sand, cinders, calcium chloride and similar materials quickly and economically. Width and depth of spread pattern is easily varied and adjusted to meet any requirement. Cab-controlled "Jets" are available in hydraulic, gasoline-driven and power take-off models, all manufactured under the most rigid engineering principles. Standard models feature 5½ and 6 cubic yard hopper capacities. Larger sizes are also available.

For complete details on "Jet" Spreaders, see your Good Roads distributor or write: Good Roads Machinery Corporation, Minerva, Ohio.

solute minimum and supplement it with native woody vegetation which, when properly selected is relatively inexpensive to maintain. There are many places where trees can add functional values for highway traffic. Grasses and legumes selected for turf should be indigenous and the type best suited for the soil should be planted. Adequate roadside parks and rest areas should be provided for the traveling public. They should be well developed areas appropriate for individual or group lunch tables, with a common fireplace to serve three or four cars. Parking areas for trucks and buses should be separated, either by a natural barrier or fence, from the pleasure vehicle areas. The areas should be so developed that 3 or 4 parks can be maintained by one crew.

"Building Maintenance Into Highways." By H. J. Neale, Landscape Consultant. PUBLIC WORKS, September, 1957.

Traffic Characteristics In Suburban Residential Areas

Suburban land use involving the construction of garden-type apartments and large subdivisions of single homes imposes an enormous traffic burden on existing highway and street systems. In this article, traffic generation resulting from suburban residential development is discussed. Two typical housing facilities, located within the metropolitan area of Washington, D. C., were selected for study. It was discovered that the two typical housing facilities added as much as 0.8 vehicle per dwelling unit per hour to the adjacent highways during the peak period of traffic flow. Whether the housing facility was a garden-type apartment development or a subdivision of single homes with an equivalent number of dwellings, the traffic generated per dwelling unit followed a similar pattern and volume.

"A Study In Traffic Characteristics In Suburban Residential Areas." By William L. Mertz, Highway Transport Research Engineer, Bureau of Public Roads. *Public Roads*, August, 1957.

Aerial Photography For the City Engineer

In the larger metropolitan areas, it is economical to have surveys and maps of the area made by commercial mapping firms. The areas involved in the small town, however, are too limited to make such work feasible. The firm of Clark and Daily, Consulting Engineers, has been solving this problem by com-

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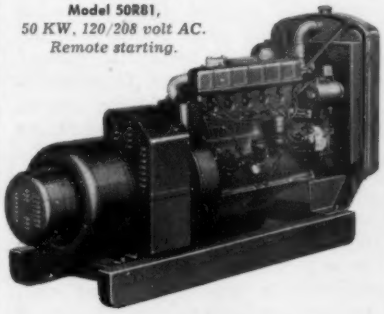

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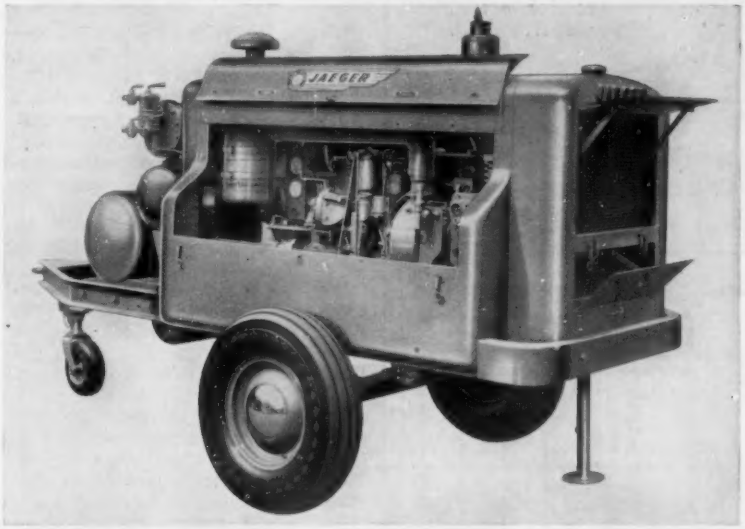

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piling their own base maps, using their own photographs and their own drafting room technique. A single engine monoplane is used to take the aerial photographs and the plane is equipped with a K-20 camera adapted for taking vertical photography. The base map is compiled in the following steps: 1) Preparation of a flight plan; 2) flying the area and making the necessary contact prints and enlargements; 3) preparing a photo index; 4) compiling an uncontrolled mosaic; 5) making ground surveys to provide horizontal control for the radial line plot; 6) constructing a radial line plot from horizontal control using slotted templets; 7) compilation of the base map at the desired scale; and 8) making additions to the base map where needed by transferring detail from the photographs or by ground survey methods in areas where required. Cost figures that could be applied in a general way to this work are very difficult to arrive at since each project has its own peculiarities of scale and flying conditions.

"Aerial Photography For the City Engineer." By Charles S. Danner, Clark and Daily, Consulting Engineers, Urbana, Ill. PUBLIC WORKS, September, 1957.

Other Articles

"Composite Welded Bridges For New York State Thruway." By Edward J. Ramer, Principal Civil Engineer (Design), New York State Dept. of Public Works. Civil Engineering, August, 1957.

"Biggest Highway Cut Ever Made." **Unusual equipment ideas** help contractor whip tough job. Modern Highways, August 15, 1957.

"Structural Designs in Wood." By Ben Benioff, King, Benioff & Assoc. Consulting Engineer, August 1957.

"Operations and Activities of **Materials** and **Research Department.**" By F. N. Hveem, Materials and Research Engineer, California Highways and Public Works. California Highways and Public Works, May-June, 1957.

"Street Lighting Abroad." Different solutions to common problems. By T. F. Cole, Secretary, Illuminating Society. Contractors Record and Municipal Engineering, July 24, 1957.

"Highway **Pavement Marking Techniques.**" By H. G. Eckhardt, Engineer of Traffic, Ohio Dept. of Highways. Public Works, September, 1957.

"Uses and Design Considerations of **Overhead Signs and Markings.**" By J. C. Bullock, Jr., Associate Traffic and Planning Engineer, Virginia Dept. of Highways. Roads and Streets, August, 1957.

"How State Highway Departments are Fighting **Problem of Lack of Personnel.**" Better Roads, August, 1957.

Waterborne Disease Outbreaks in 1956

From an article in "Public Health Reports" by C. C. Dauer, M.D., and Granville Sylvester, B.S. Both are in the Office of Vital Statistics, Public Health Service.

THERE WAS AN increase in the number of waterborne disease outbreaks in 1956 compared with those of the past several years. In 1955, there were only two outbreaks with an unknown number of cases, probably less than 50. However, in 1956, there were 9 waterborne outbreaks of disease in which 1,719 persons were affected.

The 1956 outbreaks represent 2 rather large and 2 small outbreaks among persons who drank water from contaminated public systems. One outbreak involving about 800 persons was classified as shigellosis. Shigella flexneri was isolated from stool specimens from several of the patients. The specific organism was not found in the water, but an organism resembling shigella was isolated. There was substantial evidence that the city supply had been contaminated with raw water from a mountain stream. Evidence of fecal contamination was found along the stream, probably deposited there by campers known to have used the area. In another outbreak, about 700 persons in a small town became ill after the public water supply became heavily contaminated with surface drainage following a sudden rain storm. A third outbreak occurred in one section of a city. Here, the supply was contaminated by raw water from a stream being forced into the public water system by a sprinkler system pump of a resident living in the area of contamination. A fourth outbreak was traced to contamination of the water system during repair of a city main. When a ditch was opened about the main it filled with water from seepage, necessitating continuous pumping while the repair was being done. Although the line was flushed upon the completion of the work, no sterilizing agent was used.

Three other outbreaks of gastroenteritis occurred in camps where untreated water was being used. In one camp, the local water company pumped raw creek water into the system because a well, ordinarily used as a source of supply, produced insufficient water during periods of peak demand. The remaining out-

breaks were in two separate families whose water supply was private. In one family, *Salmonella typhimurium* was isolated from stool specimens, and the water in an old dug well was found to be contaminated. The outbreak in the other family resulted from poison being dumped into a well.

Three other disease outbreaks were reported in which water was suspected, but definite evidence was lacking. One was hepatitis (number of cases unknown) in a school. Another was among social workers at a gathering held in a place where new water pipes had been installed. It was reported that the pipes had not been flushed when the system was placed in operation. The third occurred in persons attending a church camp and is described below.

Typhoid Fever — During 1956, there was an increase in number of cases of typhoid fever reported in the United States. Part of this increase was due to a relatively large number of cases which occurred early in the year in the North Central States. The fact that many of the cases were caused by one phage type (E_1) and that they were scattered over several States suggested that some article of food widely distributed through commercial channels might be the vehicle of infection. However, after an intensive investigation by State and Federal agencies, no common source of infection could be found.

Another group of persons became infected at one place but became ill in and were reported from several States. Following a church camp meeting attended by several hundred people, 27 persons became ill after returning home. Epidemiological evidence indicated that water from a well at the camp site was the medium of spread. Furthermore, an epidemic of mild diarrhea which occurred during the camp meeting strengthened the belief that this supply of water was responsible for spread of the typhoid infection. It was determined that a typhoid carrier had attended the camp and the organism isolated from her was the same type (C_5) as that isolated from the majority of the cases of typhoid.

Six other outbreaks consisting of only a few cases each were reported, all of them in association with carriers. Three were traced to contaminated food, and one was probably waterborne. A number of single cases for which epidemiological reports were received are not included in the tabular data in the original.

Gastroenteritis—Six outbreaks of gastroenteritis, with 903 cases, were waterborne, and 2 outbreaks, with 93 cases, were milkborne. In five other outbreaks there was evidence of person-to-person spread, suggesting viral infections, but virus isolations were not made. An outbreak in Colorado was first thought to have been waterborne because routine examinations showed the water supply to be substandard, but investigation revealed that the cases were not related to water consumption. The outbreak was regarded as gastroenteritis of viral origin.

Hepatitis—Eight outbreaks of infectious hepatitis were reported in 1956. One outbreak with an undetermined number of cases was similar to one reported in 1955, that is, both were among members of a football squad who had been drinking contaminated water. Another 1956 outbreak of 276 cases was also considered to be waterborne and *E. coli* was isolated from water samples. Although water was associated with these outbreaks, there was no evidence which would definitely incriminate it. None of the outbreaks in 1956 was foodborne. In about half of the outbreaks there was evidence of person-to-person transmission, and for the other half, the source was not determined.

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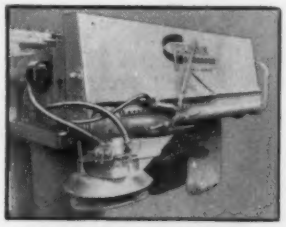

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PUBLIC WORKS DIGESTS

Prepared by
ALVIN R. JACOBSON, Ph.D
Associate Professor and Head,
Division of Sanitary Science,
Columbia University School of Public Health

THE WATER WORKS DIGEST

Softening Municipal Water Supplies

The author discusses the problem of hard water as it concerns the individual domestic consumer, the industrial plant, and the entire community; its causes and effects; variations in amounts of hardness, and the desirability of softening, even with the present increased use of synthetic detergents. The economic aspects of hardness are discussed in considerable detail. Several tables and figures are included. One table gives a comparison of the cost of soap and syndets when used with waters of different degrees of hardness. Methods of water softening are discussed together with their chemical reactions, degrees of hardness removal, and the advantages and disadvantages of each method. Comparisons of the relative costs of municipal softening versus home water softening are discussed indicating that the former method is the most economical. Several studies are referred to in this article giving probable savings that can be attributable to water softening, together with estimated costs of softening in a municipal plant.

"Softening of Municipal Water Supplies." By William W. Aultman. *Water and Sewage Works*, August, 1957.

A Ready-Made Water Filter Plant

The City of Dubuque, Iowa, has had the good fortune to locate a sand and gravel geologic formation along the Mississippi River which favors the infiltration of water from the river. Preliminary studies demonstrated that the water infiltrating from the river for a distance of 300 ft. would be in sufficient quantities to replace that withdrawn from the proposed well field. This type of filtration without the problems of mechanical equipment, back-washing, chemical handling and other responsibilities appealed to the water works personnel in Dubuque. Before deciding on wells they analyzed the other methods of water extraction, i.e., linear infiltration galleries and horizontal collectors. On the basis of their studies, vertical wells having 100 lineal feet of well screen and a spacing of 200 feet between the wells were selected as being preferable. Actually, 4 wells have been provided to meet the present needs, but the future potential will permit a maximum of 110 wells able to supply 250 mgd or more. The present capacity is 12 mgd which can be expanded to 17 mgd by changing the pump bowls.

"A Ready-Made Water Filter Plant." By J. J. Hail. *The American City*, August, 1957.

Developments in Saline Water Conversion

The search for economical methods of converting sea or brackish waters into water of a quality suitable for agricultural, industrial, municipal, and other beneficial consumptive uses was given national recognition by the enactment of the Saline Water Conversion Law of 1952. Notwithstanding the progress made, it is clear from a cost standpoint that few water shortages can, in the immediate future, look to converted sea-water as a remedy. More emphasis must be placed for the present on wiser use of existing sources of natural fresh water. Since passage of the act more than 600 suggestions and proposals have been evaluated, some 49 research and development contracts have been entered into, and 14 technical reports of completed research have been prepared. The scope of the research has been narrowed to six general fields which include various forms of distillation, solar distillation, electro-dialysis, freezing, osmosis, and a group of other physical or chemical methods of separating salt from water. A summary description of the latest developments, together with diagrammatic sketches, in each of these general fields is given in this article. The author also points out that in estimating future costs of water conversion, it is necessary to bear in mind that present projections of costs are mere infer-

● **C-O-E TRUCK with hydraulic crane is used for handling piles and poles, loading and unloading pipe, pulling stumps and doing other work of a similar nature. Truck is IHC; crane is A-W. The truck serves as a mobile operating base. Crane has a maximum extension of 34 ft. and can be elevated 52 degrees; turntable rotation is 360°. The Norfolk, Va., Dep't. of Parks & Forestry owns and operates the unit.**

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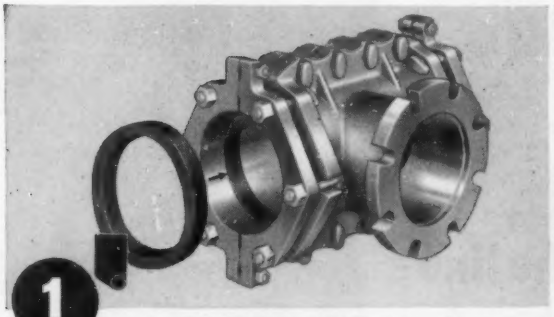

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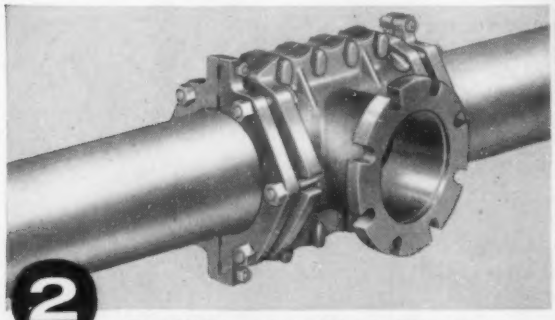

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ences based on incomplete small-scale work, and that specific cost figures must be based on future results of laboratory and large-scale tests, and in the design and operation of full-size plants. Present construction of several pilot plants, to be followed by extended test operations, should in the next few years provide important data upon which the several methods of water conversion may be evaluated and comparative costs made.

"Developments in Saline Water Conversion." By David S. Jenkins. *JAWWA*, August, 1957.

Off-the-Job Safety Programs

Off-the-job accidents last year killed 79,100 people in the United States and injured 7,450,000. In other words, 85% of all accidental deaths were a result of off-the-job accidents. The National Safety Council has shown that the cost of all accidents in the U. S. for 1955 was $10,300,000,000 — a staggering figure. When we compare it with the cost of the entire public school system in the U.S.—$7,902,702,000 for that same year, we really begin to visualize this unnecessary cost to the nation. Today, all but a very few in industrial management are convinced that industrial safety is a real source of revenue and a truly humanitarian effort. Yet very little has been done to stop this off-the-job slaughter. The author points out that it is industry's opportunity and responsibility to inaugurate safety campaigns among their employees and in their communities. The effect, from a public relations standpoint, when an industrial organization uses its knowledge of accident prevention to tackle the problem of off-the-job safety should be considered. Some of the many values to be derived from an industrial off-the-job safety program are: 1) Reduction of absenteeism; 2) opening of a new source of manpower; 3) conservation of existing manpower; 4) lowering of costs of operation; and 5) improvement of public relations.

"Off-the-Job Safety Programs." By George C. Sopp. *JAWWA*, August, 1957.

Diatomite Filters Treat Montrose Supply

The Montrose Improvement District in northern Westchester County, with a population of approximately 2,000 people, obtains its water from New York City through a connection to the Catskill Aqueduct. Water is also supplied to a 1900 bed V.A. hospital, the Village of Buchanan and two smaller water districts. Average consumption in early 1956 was about 500,000 gpd. The sanitary quality of the water meets the established criteria of public health authorities but periodically excessive turbidity appears in the water carried in the aqueduct. Since 1950, the turbidity has exceeded 10 ppm about 50% of the time and additional treatment was necessary to reduce it to acceptable limits. The poor foundation and ground water conditions in the area adjacent to the aqueduct connection led to the selection of diatomite filters as the prefered method of treatment. This method permitted the housing of all mechanical equipment, including the filters, in one building. The filters, each with a filtering area of 500 sq. ft., are of the vacuum type with the septum elements covered with Saran plastic and mounted on pipe headers in an open tank. The filter discharge is to the suction side of the filter pumps which pump the filtered water to the 300,000-gal. steel reservoir located about 300 ft. from the building. Operation of the plant is semi-automatic and its present operating capacity is 2 mgd. Space is

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available for two additional filter units and associated pumps when required. Cost of the present plant is $217,000.

"Diatomite Filters Treat Water from Catskill Aqueduct." By Richard G. Coulter, P.E. PUBLIC WORKS, September, 1957.

Other Articles

"Fundamentals of Applied **Fluoridation.**" By James L. Henry and James F. Haskett. Water and Sewage Works, August, 1957.

"**Corrosion**—Part II, More Methods of Control." By Geo. E. Symons, Ph.D. Water and Sewage Works, August, 1957.

"Holland Switches to **Lake Michigan Water.**" By G. E. Bell. The American City, August, 1957.

"Need for Planning in Utilizing **Water Resources.**" By M. J. Shelton. JAWWA, August, 1957.

"**Water Works Planning** in Great Britain." By Geoffrey M. Binnie. JAWWA, August, 1957.

"Cleaning and **Relining Small Mains.**" A Panel Discussion at the AWWA Conference, Atlantic City, N.J. JAWWA, August, 1957.

"The **Water** We Do Not Use." By Guy Browning Arthur. Public Works, September, 1957.

"Flow Control Operation for **Automatic Variable Pump Speeds.**" By C. J. Tullo and E. O. Morrison. Public Works, September, 1957.

"Court Opinions on **Pipeline Breaks.**" By John H. Murdock, Jr. JAWWA, August, 1957.

"How Probable is the **Most Probable Number.**" By Richard L. Woodward. JAWWA, August, 1957.

"Mixed Bed Ion Exchange for the **Removal of Radioactivity.**" By H. Gladys Swope. JAWWA, August, 1957.

"Design Change **Saves Money** and Land." By L. McClintock. The American City, August, 1957.

"Recording **Valve Locations** in Water Distribution Systems." By P. C. Karalekas. Public Works, August, 1957.

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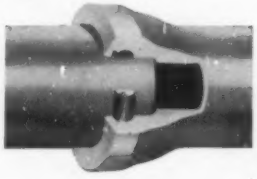

Cutaway to illustrate position of Tyton gasket inside assembled joint.

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DATA ON REFUSE COLLECTION AND DISPOSAL FROM CINCINNATI

From the annual report of Ralph C. Taylor, Superintendent, Waste Collection Division, Cincinnati, O., to W. C. Wichman, Director, Public Works Department.

PLASTIC CONTAINERS with plastic lids for garbage and combustible and non-combustible wastes were tried out during the latter part of 1956. Observations revealed no serious problem in handling this type of container.

The Waste Collection Division operates 112 packer-type refuse collection units. Of these, 26 are 9-yd.; 11 are 12-yd.; 19 are 13-yd.; 36 are 15-yd.; and 20 are 16-yd. There are also two open body collection trucks, six open body incinerator trucks and two dead animal collection trucks, three 15-ton Low Boy trailers and three 5-ton truck tractors. Dempster-Dumpster units are used extensively. There are seven 3¾-ton pick up units and a number of Dempster-Dumpster refuse containers. During 1956, an average of 245 of these containers were picked up per week. The boxes are located at 134 sites; of these 66 are at schools and 68 serve industries and other business and industrial firms. In addition, these containers are loaned to churches and other public or charitable institutions to care for special events.

In addition to these units, a considerable amount of other necessary equipment is owned and operated, including bulldozers and tractors, pumps, chain-saws, trucks and mowers.

Combustible refuse collections, including garbage, amounted to 144,-

947 tons in 1956, an increase of 1997 tons over the preceding year. A study of the weight per cubic yard during the past several years shows a gradual decline. The unit cost of collection was $8.75 per ton, of which $4.89 represented labor cost. These figures compared to $8.23 and $4.73 for the preceding year.

Non-combustible refuse collection totalled 149,284 cubic yards in 1956, a decrease of 7,165 cu. yds. compared to the preceding year. The cost of collection amounted to $3.21 per cubic yard, of which $1.92 was for labor. Comparable 1955 costs were $2.87 and $1.74.

During 1956, 218,753 tons of garbage and combustible refuse were disposed of by incineration at a total cost of $449,199. This amounted to an overall cost of $2.22 per ton of which $1.81 was for labor. There are three incinerators in service—West Fork, Dunbar and Crookshank. Lowest cost was at West Fork—$1.86 per ton; and highest at Crookshank—$2.32 per ton.

Per capita cost for collecting combustibles was $2.53, which included dead animal collection. For non-combustibles, the cost was 95 cents per capita. With an additional charge of 17 cents per capita for miscellaneous items, total costs for collection amounted to $3.65 per capita. The cost of incineration was 89 cents per capita, giving a total per capita cost for collection and disposal of $4.54.

Non-combustible material is disposed of at suitable dump sites which are kept neat and level, with exposed surfaces covered with an earth layer whenever suitable material can be obtained.

In the latter part of March 1956, a Public Service Inspector was added to increase the effectiveness of the Anti-Litter Campaign. The Inspector worked with the District Foremen in cleaning up bad litter areas. Their problem was to contact the public in person, explain the proper method of preparing wastes for collection and solicit co-operation in the City's efforts to maintain a clean city. Only after a recheck of an area which had been previously contacted were Official Notices of Violation issued. The Inspector made over 2700 calls in the nine-month period, in addition to the contacts made by the District foremen.

It is felt that the continuing effort is reflected in a marked improvement in the conditions due to improper waste preparation and that with continued public support, Cincinnati will be a cleaner city.

Thank You, Mr. Butts
for this most interesting letter

VILLAGE OF SHERBURNE
SHERBURNE, N. Y.

March 20, 1957

Dicalite Department
Great Lakes Carbon Corp.
612 South Flower Street
Los Angeles 17, Calif.

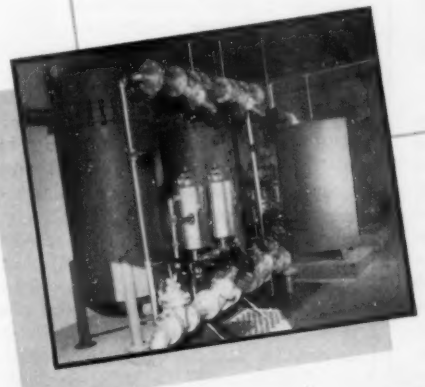
Gentlemen:

I wish to take this opportunity to advise you of the excellent experience we have had with Dicalite Speedplus in the operation of our Municipal Diatomite Water Filtration Plant.

For the last two years of operation we have used an average of 402 lbs. Dicalite Speedplus per million gallons. This has resulted in a net cost to us of about 4.7 cents per 1000 gallons including labor, filtration, pumping costs, plant equipment, etc.

I am in strong support of Diatomite Water Filtration for small Municipalities such as ours.

Very truly yours,
Herbert Butts Supt
Herbert Butts, Supt.
Village of Sherburne Water Dept.



The results obtained at Sherburne, and in other communities which have used Dicalite over a period of several years, provide ample evidence that diatomite filtration of municipal water supply is practical, economical, safe and relatively simple, requiring no highly-trained personnel.

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ORDER from Book Department, PUBLIC WORKS, 200 So. Broad St., Ridgewood, N. J. Only $1.00 per copy.

1956 Sewage Treatment Plant Construction

DURING 1956, $354.3 million of contracts for the construction of sewage treatment works were awarded by municipalities in the United States. Of this amount, contracts totalling $314.7 million are identified as to specific location and type of project in the report. The balance of $39.6 million consists, in part, of some small contracts not identifiable from records in the State health department offices, and, in part, of "mixed" contracts for water works, collecting sewers, and treatment plants, of which a part has been apportioned to sewage treatment plants. This report relates only to the identified contracts amounting to $314.7 million.

The term "municipalities" includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties and towns; significant institutions, resorts, recreational centers, or other population centers; and industries discharging sanitary sewage wastes directly to watercourse.

The $314.7 million volume includes 720 identified contracts, and is the highest such value on record. It includes five contracts amounting to $78 million for one of the largest single projects ever recorded. It does not reflect the effect of the Federal grant program under Public Law 660, since this provision of the law did not come into full operation until late in the year. Grant offers were made for only nine projects under this law before December 31, 1956.

Of the $314.7 million involved in those projects actually identified by the States, $113.7 million was awarded for 348 new treatment plants. The number of new plants is down 6.2 percent from 1955, but the dollar value is 31 percent higher. The balance of the $314.7 million, or $201.0 million, went for 372 projects for the construction of outfall and interceptor sewers, and enlargements and alterations of existing plants. The number of such projects was about the same as in 1955, but the dollar volume was 76.2 percent greater. The percentage division between new plant and other, in terms of dollars, was 36-64 in 1956, compared with 43-57 in 1955. Sanitary collecting sewers and storm sewers are not included in this report since their construction does not represent a reduction in pollution to natural watercourses.

More than half the number of contracts were for projects to serve populations of less than 5,000. From 1952 to 1955 inclusive, such projects accounted for 15 to 22 percent of the dollar volume. In 1956, more than half the contracts took up only 11 percent of the total. This apparent distortion is brought about again by the $78 million project, for if it is removed from consideration, those contracts for populations under 5,000 account for 15.1 percent of the dollars, which is within the range of other years.

The effect of this large project on distribution is more noticeable in the data for projects other than new plants. From 1952 to 1955, 50 percent of those projects have been for populations under 10,000, and also accounted for 15 to 22 percent of the money. In 1956, the median size of the population served for this type of construction was slightly over 10,000, but these 50 percent accounted for only 10 percent of the money. Disregarding the large project, the population doesn't change substantially, but those contracts account for 15 percent of the dollars, again within the range of past years.

A comparison of contract awards by size of contract is readily available only for this year and last. The exact 50 percent level is not known, but in both years 48 percent of all contracts were under $100,000. These contracts accounted for only 7.5 percent of the total value in 1955 and 4.7 percent in 1956. For new plants, contracts under $100,000 accounted for 8.1 percent of the volume in 1955 and 6.9 percent in 1956, whereas in "other projects" it was 7.0 percent in 1955 and just half of that, 3.5 percent, in 1956, again reflecting the interceptor portion ($62 million) of that one large project. This project shows its effect in another way. In 1955, 50.4 percent of the dollar volume for "other projects" was in contracts under $1 million. In 1956, only 28.8 percent was under $1 million.

These data are from "Public Sewage Treatment Plant Construction" by the Public Health Service. In addition to the material presented, the booklet contains comparisons on the volume of contracts awarded for sewage treatment plants during 1956, with information on place, type of construction and cost. Copies of the booklet can be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for 15 cents each.

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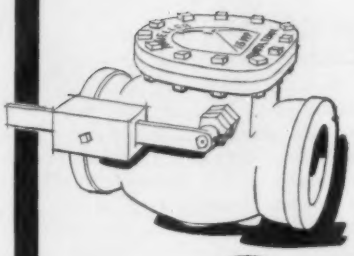
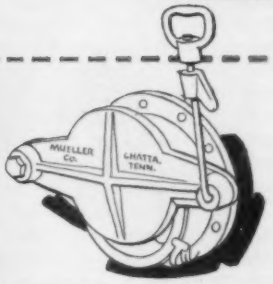


Shear Gates Iron body, bronze seat ring and disc ring. Flanged, hub or spigot frame. Sizes from 4" through 24". Furnished with 2' lift handle and catch. Gate latches 30° below horizontal. This design permits full opening of gate – no obstruction of orifice.



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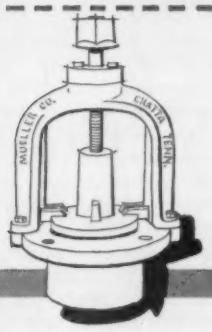

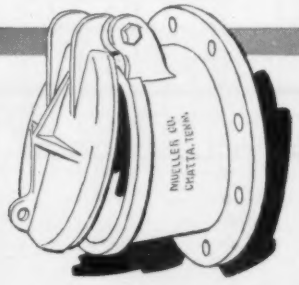

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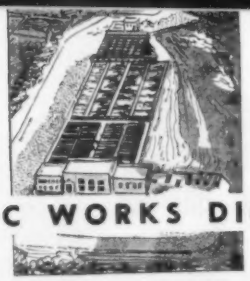


PUBLIC WORKS DIGESTS

Prepared by
ALVIN R. JACOBSON, Ph.D.
Associate Professor and Head,
Division of Sanitary Science,
Columbia University School of Public Health

THE SEWERAGE AND REFUSE DIGEST

10-Yr. Refuse Service Contract Awarded

Santa Barbara, Calif., has awarded a 10-year contract to a private refuse collection firm. This new contract was awarded at the conclusion of a thorough study by a 3-man committee in which they conferred with health, fire and sanitation experts from other communities. The public was also requested by questionnaire to give their views. There was a marked desire by the public for pickup service, twice a week collection, and banning of backyard burning. Additional information led the commission to recommend the adoption of a new city ordinance to incorporate these requirements: 1) A 10-year contract, permitting the contractor time to amortize equipment before expiration of the contract; and 2) all persons having refuse within the city shall subscribe to regular collection and disposal services, without any exceptions. By ordinance and contract, the contractor must provide no less than 10 packer trucks of a type approved by the city. The city also reserves the right under the contract for approval of contractor personnel and the color and type of uniform to be worn by the employees. Regular service constitutes twice a week pick-up of two standard 32-gallon containers of refuse. The rates established according to the class of customer are given in some detail. The refuse must be disposed of at the city-owned but contractor-operated sanitary landfill site according to the most rigid standards of operations specified in the contract. Other conditions provided for in the ordinance and contract are also covered in this article.

"Santa Barbara Awards 10-Year Refuse Service Contract". By William T. Hopkins. *The American City*, August, 1957.

Oxygen Demand Removal Studies on Digester Liquor

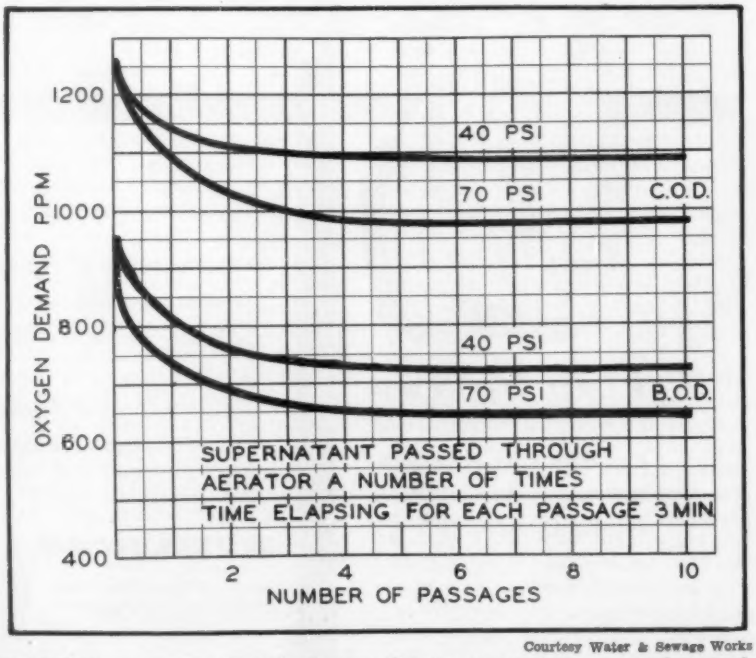
The author reports on some interesting experiments which show that the supernatant liquor from digesters has an immediate oxygen demand that can be removed by adequate aeration. It has been known for some time that this liquor has had a deterrent effect on the efficiency of secondary treatment, due to the high oxygen demand which robs the flora in the secondary treatment units of the supply of oxygen necessary for aerobic growth. Laboratory and field tests were made on the digester supernatant of several yeast wastes. The results of the studies indicate that the immediate oxygen demand was due in large part to sulfides, including hydrogen sulfide, resulting from anaerobic decomposition. Aeration of this supernatant liquor under pressure indicated that the immediate oxygen demand could be reduced materially.

Other studies on simulated samples made by the addition of Na_2SO_3 of Na_2S, with and without $CuSO_4$ as a catalyst, were performed. The oxidation of these compounds was shown to be relatively slow in the absence of a catalyst and also slow by aeration at normal atmospheric pressures. With the addition of 3 ppm or more of $CuSO_4$ the oxidation proceeded fairly rapidly and the period of aeration became relatively short. The results of the tests on the simulated samples are tabulated in the article.

"Immediate Oxygen Demand Removal From Digester Supernatant Liquor." By H. O. Halvorson, Ph.D. *Water and Sewage Works*, August, 1957.

Good Sewer Construction

The six basic factors to be considered by the engineer in the proper design and construction of a sewer system are: 1) Depth of fill over the top of the sewer; 2) width of trench at the top of the sewer pipe; 3) the type of bedding; 4) laying, jointing, and finishing; 5) backfilling; and 6) safety inspection. The first three of these factors are fundamental to the determina-



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● **CURVES of oxygen demand of yeast digester supernatant, no catalyst used.**

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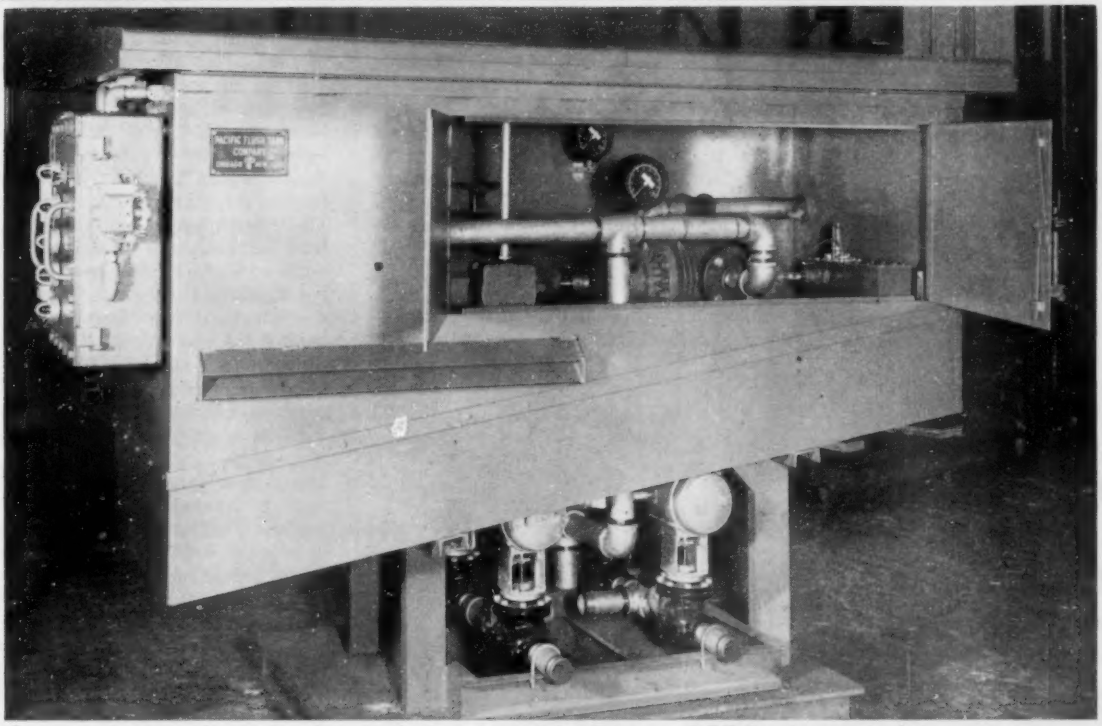
NEW DEVELOPMENTS IN SEWAGE TREATMENT



Compressor housing with controls and motorized valves—heart of the efficient new P.F.T.-Pearth gas recirculation system.

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Low cost insurance against possible scum difficulties. Future installation of Pearth system, without interruption of digester operation, is simple and economical when optional discharge wells are specified for new P.F.T. Floating Covers.

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There are no moving parts in the digester, and no restrictions in the open end gas discharge piping. Hence, no danger of mechanical failure or clogging with this trouble-free system.

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tion of the strength of the pipe necessary. These values are all inter-related and to change one requires the readjustment of the other values. The last three of the basic factors are important to the actual construction of the sewer line and the restoration of the excavated area to its original or planned final condition. These three factors are also equally important and also inter-related. The author discusses each of these six basic factors with equal clarity.

"Good Practice in Sewer Construction—The Only Way Is the Right Way." By Sherwood Borland. PUBLIC WORKS, September, 1957.

Fly Ash Emission Limits From Incinerators

Increasing numbers of communities during recent years have been confronted with the problem of disposal of larger amounts of combustible waste materials. Many of these same communities have had to decide on incineration as the method of choice because of the lack of suitable sites for sanitary land fill operations. It is pointed out that in this day and age incinerators must be designed to operate in any type of community without causing a nuisance. In many communities rigid limitations on smoke and fly-ash emissions are imposed through local ordinances and are based on maximum dust or fly-ash loadings per given quantity of stack effluent. From a survey of maximum loadings as specified in various air pollution ordinances they may be listed according to 12 different limitations as shown in this article. Specifications for new incinerators require a high temperature for complete combustion. Combustion chambers of adequate dimensions and with secondary air provisions are required. The organic content of the resultant ash must be rigidly limited so that it will not prove offensive to nearby residents. Incinerator performance must conform with local air pollution limitations to prevent fly-ash deposition. Therefore subsidence chambers of large dimensions or water sprays may be specified. In addition, air pollution control technicians may conduct a series of sampling and analytical procedures to determine whether or not the amount of particulate matter being discharged into the atmosphere exceeds the limitations prescribed in the local ordinances or by the specifications. The author feels that many of the testing methods have been adapted from other test procedures resulting in a great lack of uniformity in results obtained by the various air pollution agencies. He makes a suggestion for a study and review of the testing procedures and limitations criteria for municipal incinerators in order to develop a standard set of procedures and the proper type of sampling apparatus. In this way any community can feel secure in the knowledge that their newly completed incinerator is not creating an air pollution nuisance.

"Fly Ash Emission Limits and Standard Test Methods For Municipal Incinerators." By Bernard J. Geisheker. PUBLIC WORKS, September, 1957.

Other Articles

"How We Financed and Built a **Sewage Treatment** Plant." By P. Theo. Olsson. The American City, August, 1957.

"The Operator's Responsibility for General **Plant Maintenance.**" By Wallace Grant. Water and Sewage Works, August, 1957.

"Flow Control Operation for **Automatic Variable Pump** Speeds." By C. J. Tullo and E. O. Morrison. Public Works, September, 1957.

"Feeding Dried Activated Sludge to Pigs, Poultry, Steers and Sheep." By

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E. Hurwitz. Wastes Engineering, August, 1957.

"Designing **Biological Filters** for Optimum Loading and Dimensions. No. 3 of a Series. By Rolf Eliassen. Wastes Engineering, August, 1957.

"**Package Sewage Treatment** Plants." By Theodore Jaffe. Water and Sewage Works, August, 1957.

"Planning **Refuse Disposal** for a Metropolitan County." Public Works, September, 1957.

DOES PREVENTIVE SEWER MAINTENANCE PAY DIVIDENDS?

A. J. WAHL
Superintendent,
Sewage Treatment Plant
Boise, Idaho

SOME THINGS can not be figured in actual dollars and cents in the profit or loss column, but in the column of public relations they show a big dividend. One facet of city service to the general public is the maintenance of the public sewers.

We all know that, when a sewer lateral or main plugs, flooding of basements and damage suits result. The first is a nauseating experience for the citizen and the second a liability to the city. The latter may be covered by insurance but all such rates are based on previous performance of operation. Therefore cost-wise this pays a big part in the cost of the insurance premium.

In all preventive maintenance work, three items are of prime importance: 1. Scheduled inspection; 2. routine operation; and 3. records of operation.

In like manner, maintenance of the public sewer system to keep a constant flow without interruption of service is mandatory within human possibilities.

Scheduled Inspection

It is known that sewer gradients in lines may have changed since construction due to poor subbase or for other reasons. This may cause a flat spot or at times a short section of adverse grade which will impede velocity and cause a settling and collection of debris which in time causes stoppage of flow.

Also root growth, the major cause and enigmatical problem of the sewer maintenance crew, is an everlasting problem in many sections of

Best Method of Ice and Snow Control is the "Scotchman"® Method:

spread de-icing salts Early; Light; Wide

Cost-conscious maintenance men prefer the "Scotchman" for spreading clear chemicals. Reasons: It's **Faster.** It's more **Convenient.** It more than pays its way in **savings of Time, Labor,** and **Materials.**

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any city. Products are on the market which have, to some degree, helped in the stoppage of such growth. Root growth in general is slow in maturing to the extent it will cause stoppage of sewage flow. Usually a sluggish flow will be noticed first. Then and there is the time to correct the situation which is bound to happen if preventive maintenance is not practiced.

Periodic inspections must be made at the manholes to ascertain whether sewage flow velocity is normal. If not, immediate steps must be taken to correct the sluggish flow condition.

Table 1—Sewer Maintenance Cost Record

Year	Labor	Supplies	Total
1952	$9,507.63	$2,139.50	$11,647.18
1953	8,629.10	2,114.19	10,743.29
1954	9,076.38	3,521.63	12,698.01
1956	7,961.75	2,906.25	10,868.00
1955	7,855.98	2,298.73	10,165.71

Operation and Records

The operation plan for sewer maintenance should be set up to cover, under normal conditions, one section of public sewer system at a time. This eliminates unnecessary moving about of equipment and loss of time. Only on observation of a critical sluggish flow condition should the scheduled planned cleaning program be disrupted.

We find that with a white print small-scale map of the entire sewer system and the use of a color legend we can keep track of all work performed each year. For example:

1. Flushing of dead-end laterals each spring is indicated by yellow coloring and dates when work is performed are put on the map.
2. All sewer lines cleaned with the bucket machines are marked in red with dates of work performed written on map.
3. All emergency calls and lines specifically rodded by the mechanical sewer rodder are also recorded.

Emergency calls are recorded by name; address; time of call; time on the job; cause of trouble; and any damage that may have resulted. This record is invaluable in any future damage claim cases.

All locations in which emergency work is performed are also placed on the map. Then each summer these places are cleaned thoroughly with the mechanical bucket machines. In addition, each summer a section of the public sewer system is also cleaned with mechanical bucket machines.

What have we gained? The recorded number of emergency calls dropped from 158 in 1952; to 112 in 1953; to 93 in 1954; to 81 in 1955; and to 58 in 1956. The cost as shown in the table did not increase although the wage rate per hour per man did increase. The number of calls each year decreased with the result we had less complaints and only two small damage suits (less than $100 each) in three years.

Good equipment is essential and we recommend suitable rodding equipment, with various size augers, to relieve flow stoppages. We have a trailer mounted Flexible Mechanical SewerRodeR complete with mechanically operated steel rods. At no time is the operator required to get in personal contact with sewage.

New Tennant "80" Sweeper:

it picks up the dirt most sweepers miss

Over 80% of all "critical area" sweeping jobs in the U.S. today are done with TENNANT vacuum-equipped Power Sweepers.

This is because these heavy-duty units are expressly engineered to provide unusual dust control—*the closest approach to dust-free sweeping yet developed.*

The Tennant "80" sweeps a 42" path (53" with sidebrush), picks up *all* types of litter on-the-run, dumps hydraulically. *Write for illustrated bulletin.*

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SETS A NEW STANDARD IN CLEAN SWEEPING

We also have two mechanical sewer bucket machines equipped with gasoline operated engines. These are excellent to clean sewer lines of sand, roots and other debris. The total cost of this equipment five years ago was approximately $7,000. The yearly maintenance cost of all the equipment in sewer rods, augers, tools, cable and buckets are included in the maintenance and supply column of Table 1. This also includes cement, sand, etc., required to raise and lower existing manholes; replacement of broken manhole covers and rings; and emergency replacement of broken sections of sewer pipe.

The cost of equipment maintenance averages only 7½ percent per year of the original equipment cost —approximately $500 per year. This cost in dollars is minor in the maintenance of 74½ miles of public sewers ranging from 8-in. to 42-in. in diameter.

• • •

The New Highways: Challenge to the Metropolitan Region

A symposium on the question "How Can We Increase the Efficiency and Livability of Our Cities Through the National Highway Program?" was sponsored by the Connecticut General Life Insurance Co. It was held September 9-12, 1957 in Connecticut General's beautiful new office building. This structure shows how some businesses can move from the center of congested downtown areas of cities to the suburban areas.

Many highway administrators, city planners and engineers, utility officials, housing developers, realtors, businessmen and architects attended this symposium to discuss the new highway program and its challenge to the metropolitan region. The panel discussions covered these points: The relationship of highways to the pattern of land use; the highway's impact on production, merchandising, living and shelter; the highway's place in metropolitan transportation; making the highway a tool for the future city; and the challenge of the Hartford capital area.

Many valuable ideas were presented by the panelists that may have future bearing on the highway program. From questions asked by the audience, it proved that better co-operation is needed between highway designers and city planners.

Bertram D. Tallamy, Federal Highway Administrator spoke on the highways of the Future and Albert M. Cole, Administrator, Housing and Home Finance Agency, on highways and urban renewal.

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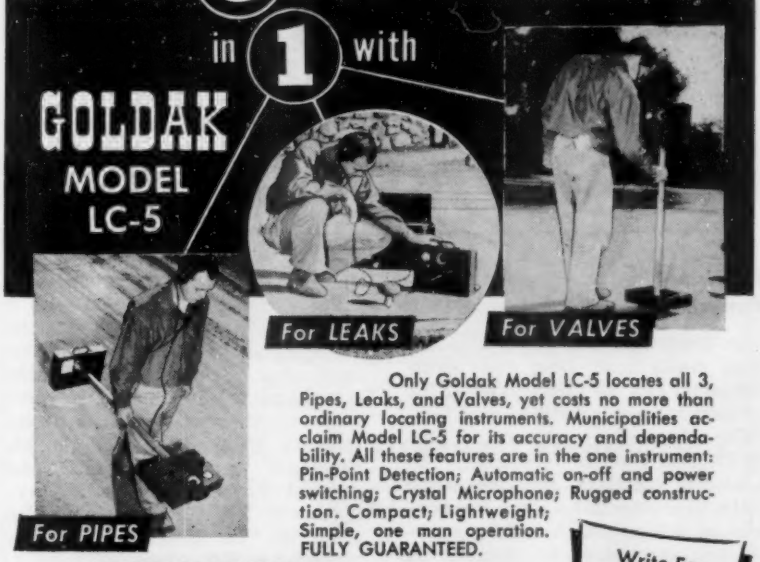

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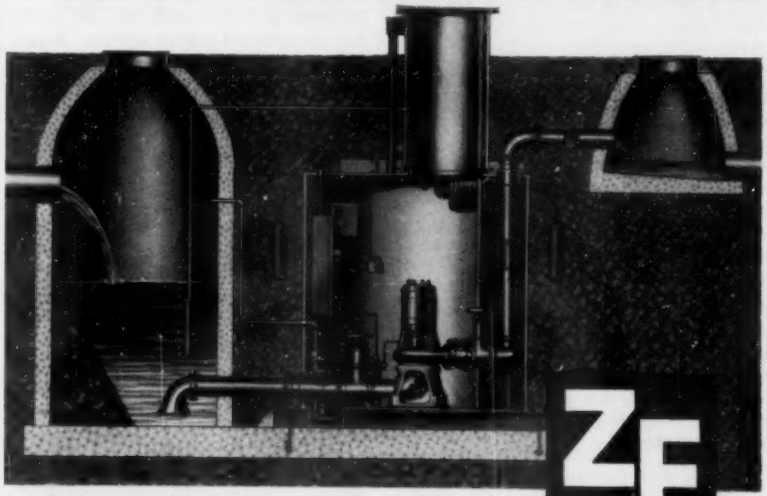

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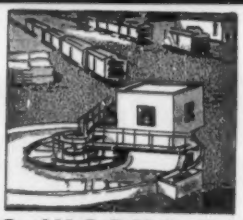


PUBLIC WORKS DIGESTS

Prepared by
CLAYTON H. BILLINGS
Associate Editor

THE INDUSTRIAL WASTE DIGEST

Reducing Pollution Potential of Textile Wastes

In-plant reduction of the industrial waste load from the textile industry can be accomplished by process control, substitution of low-BOD chemicals for those of high BOD, and good housekeeping. The Con-Mill method for measuring reduction potential values for control of dyeing and bleaching operations succeeded in minimizing chemicals used. Methods of dyeing have been changed, also, for the purpose of waste control. The reuse and control of caustic is important in producing a waste effluent susceptible to biological treatment. An example of substitution is the use of carboxy methylcellulose instead of starch, the former having only 2 percent of the BOD of starch. Pilot-plant experiments on treatment methods for textile wastes showed that a lagoon can be used as an equalizing basin and to remove BOD and color; but improved results can be obtained if the wastes are combined with sewage, and odors are disregarded. The most economical chemical treatment procedure involved mixing of the wastes for combined treatment. Highly alkaline waste is more easily treated by trickling filters and the activated sludge process if it is combined with domestic sewage. It was found that this latter method would reduce the pollution potential of the waste sufficiently to make it acceptable for discharge to a stream.

"Textile Wastes-Recovery and Treatment." By R. H. Souther and T. A. Alspaugh, Cone Mills Corp. *Sewage and Industrial Wastes*, August.

Colorimetric Determination of Citrus Waste COD

Investigations being conducted on the treatment of citrus wastes on a pilot-plant scale, where a wide variability in concentration was encountered, required a quick method of strength determination. The procedure of Moore, the dichromate reflux method, was studied with a view to modifying it to estimate the COD of citrus waste colorimetrically when the dichromate solution is reduced. A Beckman DU spectrophotometer was used to study spectral transmission differentials developed between oxidized and reduced chromate solutions at varying wave lengths. It was decided that the 52 percent difference obtained at 650mμ was sufficient to assay the strength of citrus waste colorimetrically. A reference curve relating percent transmission values to ppm COD was prepared using standard sugar solutions and measuring percent transmission at 650 mμ with a Fischer electrophotometer. With a permanent color blank, the complete oxygen demand determination can be made in about 20 minutes. Satisfactory correlation was obtained between this method and direct analysis of raw citrus

Baling Leaves Reduces Autumn Problem

LEAVES NO LONGER constitute a fall headache for the Attleboro, Mass., Park Commission because Superintendent Robert Sharkey has come up with an ingenious and practical way of clearing the ground before winter. Where five to six weeks formerly were required to clear the Attleboro parks of leaves, the Commission now does the job in little more than a week with a Farmall tractor and McCormick pickup hay baler, rented from a nearby farm.

Not only has baling cut labor requirements in maintaining the City's parks, but the leaves, packed in bales, are turned into valuable compost for mulching shrubbery and working into the soil around newly planted trees and shrubs. The four to five hundred bales of leaves taken from the parks each season are piled for composting and require two years to reach a good state of decomposition.

A small walk-behind tractor equipped with a large pusher basket is used to rake and push the leaves into windrows on park roadways or in open areas. Once on the road or in the open with no trees or overhanging limbs to bother, tractor and pickup baler quickly pick up the loose leaves and convert them into bales which are easily handled, transported and stored.

Mr. Sharkey says he can turn out a bale a minute when leaves are dry. However, unlike farming, it is not necessary to make leaf hay while the sun is shining; leaves sometimes are baled when so wet that water runs from the bales.

waste samples. While more accurate results are possible with photoelectric instruments, it is feasible to prepare color standards that have sufficient permanence to make a fairly good approximation of the COD values by visual comparison, when an instrument is not available.

"Determination of the Chemical Oxygen Demand of Citrus Waste Waters." By R. R. McNary, M. H. Dougherty and R. W. Wolford, Florida Citrus Experiment Station. *Sewage and Industrial Wastes*, August.

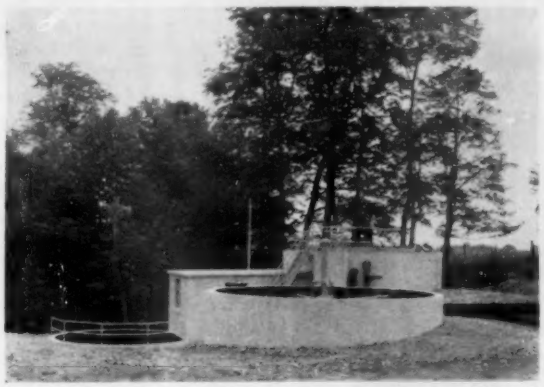
Test Methods for Phenols in Wastes

In view of the need for rapid and reliable procedures for determining phenol in water, applicable to a wide range of concentrations with particular emphasis on those less than 10 ppb, five methods were evaluated regarding sensitivity, precision, accuracy, interferences, reagents and time requirements. There were three colorimetric methods: the Gibbs procedure, the nitrosophenol method, the 4-aminoantipyrine procedure, and two spectrophotometric methods developed within the last five years: the infrared absorption procedure and an ultraviolet technique. All but one of the procedures were objectionable from the time element standpoint, requiring an hour or more. The 4-aminoantipyrine procedure is the fastest, most precise and accurate of the colorimetric methods even in the lowest ranges of phenolic concentrations. The ultraviolet absorption method appears to offer promise for determining all the phenolic-type compounds found in refinery waste waters in all ranges. It is currently believed that it is the best because it is not insensitive when the coupling position becomes blocked.

"Determination of Phenolic-Type Compounds in Water and Industrial Waste Waters." By E. F. Mohler, Jr. and L. N. Jacob, Sun Oil Co. *Analytical Chemistry*, September.

Radioactivity and Sewage Treatment

The recommendation that no organ of the body should receive more than 0.3 rad per week of ionizing radiation is the basis for published maximum concentrations of radioisotopes in drinking water. This is considered acceptable in occupational health protection, but for the general public it is thought wise to reduce this to 0.03 rad. For radioisotopes discharged to sewers



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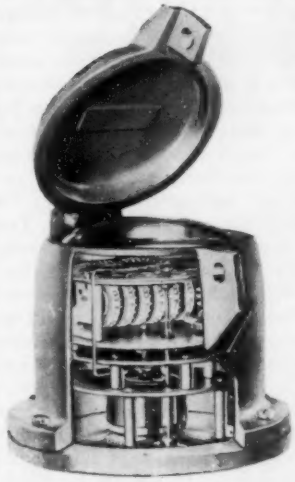

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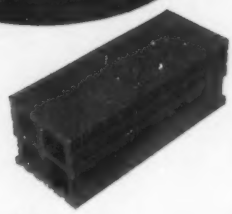

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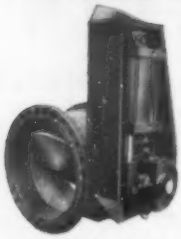

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and rivers, other factors such as surface absorption need to be considered. At the present scale of use, there appears no general reason to be apprehensive about the effect of discharge of radioisotopes in liquid wastes, on the subsequent user or on the worker. Very little radioactivity is removed in primary sedimentation. In treatment by filters and activated sludge, the proportion of the active isotope removed is the same as the proportion of the inactive isotope removed and depends on the concentration. In general, results are better, the higher the valence of an ion. Sulfur, cobalt and strontium are important bivalent ions in sewage treatment, and of these only cobalt is retained in the treatment process. Radiophosphorous is the most important of trivalent radioisotopes. Higher concentrations of synthetic detergents are likely to result in increasing difficulty with phosphorous. The lower forms of life in filters and sludge are, in general, very resistant to radiation. While workers at sewage treatment plants are not likely to be exposed to any significant radiation dosage under present conditions, if higher levels of long-lived radioisotopes which are strongly adsorbed were persistently present in sewage, determination of radiation dose rates by measuring might be necessary. In regard to using radioactive sludge as fertilizer, there is probably time for considerable decay to take place before it is used; in fact, substances like strontium, easily taken up by plant growth, are not adsorbed on sludge. Ion exchange properties of the soil are likely to result in removal of radioactive isotopes, if sewage is given land treatment. The expanding use of nuclear power and the increase in use of radioisotopes should increase apprehension that damaging wastes could be discharged without prior realization of the fact. This points to the need for watching the situation closely.

"Radioactive Discharge to Sewers and Rivers." By W. A. Kenny. *Contractors Record and Municipal Engineering*, July 17.

Field Turbidimeter For Mining Wastes

The need for a portable turbidimeter for field determinations on mining waste samples prompted the modification of a standard laboratory Hellige instrument for this purpose. The turbidimeter was mounted on a wooden base to provide stability for its use in an automobile, and it was rewired to utilize a 6-volt power

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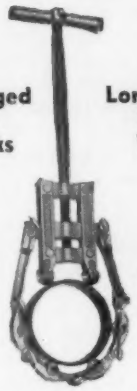

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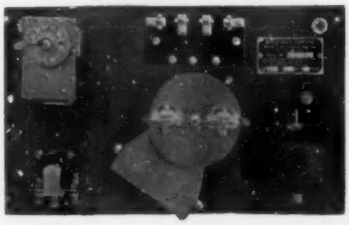

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source. Voltage controls were added to the circuit, consisting of 0.5-ohm fixed resistance and a 25-ohm variable resistance in parallel and a DC voltmeter. The instrument was calibrated by means of the standard turbidity suspension for the particular type of instrument. Operation was standardized at the convenient level of 5½ v. Some 30 samples of iron ore mining wastes were analyzed in the field and later in the laboratory for comparison purposes. The results of an analysis of the data indicate a high degree of correlation between the analytical results obtained by the field method and the laboratory method.

"Modified Laboratory Turbidimeter for Field Use on Mining Wastes." By C. A. Johannes and R. D. Miller, Minnesota Dept. of Health. *Sewage and Industrial Wastes*, August.

Other Articles

"Waste Treatment in the **Atomic Age.**" By Kenneth S. Watson, Sewage and Industrial Wastes, August, 1957. Some of the outstanding waste control developments which will have application in this eventful era are reviewed.

"Clarification of **Dredge Mining Waste** Waters." This summary of a mining waste problem in Idaho is presented in two sections: "I. Clarification Tests" is by Aleck Alexander, Idaho State Board of Health; "II. Treatment of Waste Waters at Bear Valley, Idaho" is by Robert P. Porter Bros. Corp., a dredge-mining firm. Sewage and Industrial Wastes, August 1957.

"Ultramicrodetermination of **Sulfides in Air.**" By M. B. Jacobs, M. M. Braverman, and Seymour Hochheiser, New York City Dept. of Air Pollution Control. Analytical Chemistry, September, 1957. For air pollution investigations, industrial hygiene techniques for H_2S determination are not suitable. Sulfides can be measured in the parts per billion range by bubbling air through an absorption mixture of an alkaline suspension of cadmium hydroxide in a Greenburg-Smith impinger.

"**Biochemical Reduction** for Industrial Wastes." By Vladimir Madera, Institute of Chemical Technology, Prague. Contractors Record and Municipal Engineering, July 31, 1957. Anaerobic digestion processes have so far been investigated for waste waters with a high content of organic matter. There are other useful applications in industrial waste treatment.

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Air Pollution and the Courts

(*Continued from page* 99)

gas———." This case simmered in the courts for nearly a decade, and came back for further and final determination in 1915 and 1916[4].

Municipal Control of Air Pollution

Since prevention of any nuisance, including air pollution, is better than its cure, the state under its vested police power may enact and enforce reasonable legislation to: prohibit, control, and penalize improper pollution of the atmosphere; to establish appropriate standards for and regulate industrial processes causing such pollution; and, if deemed advisable, to require permits for such operations, which may be granted, denied, suspended, or revoked for proper cause after a hearing. These powers may, furthermore, be delegated by the state to municipal corporations and other governmental agencies, which may be authorized to supplement the legislation with suitable technical rules and regulations[5].

An ordinance of the City of Des Moines, Iowa, making emission of dense smoke in the city a public nuisance came before the Supreme Court of the United States in 1916. An industry affected by this legislation sought an injunction against its operation, bringing suit in the Federal District Court, which denied the writ. In sustaining the ruling of the lower court, the Supreme Court said that, "So far as the Federal Constitution is concerned, we have no doubt the state may by itself, or through authorized municipalities, declare the emission of dense smoke in cities or populous neighborhoods a nuisance and subject to restraint as such; and that the harshness of such legislation, or its effects upon business interests, short of a merely arbitrary enactment, are not valid constitutional objections"[6]. The court cited numerous rulings by the highest state courts to the same effect.

In 1950, nearly half a century after this leading decision, the Supreme Court of New Jersey upheld as valid and constitutional an ordinance of a local board of health prohibiting air pollution by smoke and other means. A railroad company which maintained a power house in the township had been convicted in the Municipal Court of violation of the ordinance. On appeal the conviction was upheld, the New Jersey Supreme Court saying that, "There can be no doubt that the regulation under review has a substantial relation to the public health. Dense smoke, a carrier as it is of dust, soot and cinders, contaminates and pollutes the atmosphere and deteriorates its normal healthful qualities, and therefore cannot but be harmful to the public health, especially in populous areas. This is a matter of common experience, so much so that it is properly a subject of judicial notice."[7] To the same effect was another decision by this same court in 1952, holding that a statutory declaration of dense smoke and fumes as a public nuisance was a proper and reasonable exercise of legislative authority[8].

During the past half century there have been numerous other court decisions in this country sustaining the right of states and municipalities to undertake control of air pollution for the common good[9]. In some instances the courts have decided that under the peculiar conditions of a particular case the emission of smoke and fumes or the creation of dust was not a nuisance[10].

Governmental Regulation of Air Pollution

Although the problem of air pollution has been greatly intensified in recent years, and now seems worse than ever in history, this matter has been the concern of government for many centuries. As long ago as 1306 a Royal Proclamation was issued in England by Edward I forbidding the use of sea coal in London, and setting up a Commission to, "punish miscreants for the first offense with great fines and ransoms, and upon the second offense to destroy their furnaces," a drastic method of abatement. In the reign of Elizabeth I, nearly three centuries later, an edict made illegal the burning of coal in London when Parliament was sitting. Not until 1875, however, was smoke declared by law to be a legal nuisance, and not until 1926 was a definite smoke abatement act adopted in England, to be superseded in 1956 by a new and more comprehensive law, the Clean Air Act.

Official and public concern about dangerous air pollution has been accentuated in recent years by several unfortunate episodes in which numerous deaths were attributed to poisons in the atmosphere. These incidents occurred in the Meuse Valley in France in 1930; in Donora, Pennsylvania in 1948; in Poza Rica, Mexico in 1950; and in London in 1952 and 1954, where several thousands deaths are alleged to have been due to smog over that city. In Donora there were 20 deaths, mostly among aged persons. A lengthy investigation there by the United States Public Health Service failed to uncover any specific chemical as responsible, but pointed to general pollution of the air during adverse meteorological conditions.

After the Donora catastrophe Federal legislation on air pollution was adopted by the 84th Congress (Public Law 159), to become effective July 14, 1955. This law authorizes research on air pollution by the Public Health Service of the Department of Health, Education, and Welfare, and cooperative activities with state and local governments, and with private agencies, in the prevention and abatement of air pollution. This work is being undertaken at the Robert A. Taft Sanitary Engineering Center of the Public Health Service at Cincinnati, Ohio.

Smog Over California

Long-lasting and virulent smogs in and about the metropolitan area of Los Angeles apparently resulted from the tremendous industrial expansion of that section during World War II. This serious air pollution, which caused ocular irritation, respiratory troubles, and injury to property, stimulated enactment by the California Legislature in 1947 of a law prohibiting atmospheric contamination, and empowering counties to set up air pollution control districts. Los Angeles activated such a district in 1948, and several others also have been organized. Despite ardent efforts at enforcement, smog has continued to be a most severe problem in this area.

This law came before the California courts in 1951 when a corporation appealed from a conviction in a Justice's Court for violation of the Health and Safety Code of Los Angeles County on air pollution. The code provided that no person shall discharge into the atmosphere from any single source for a period of more than three minutes in any one hour any air contaminant which is as dark or darker than the No. 2 on the Ringelmann chart of the United States Bureau of Mines, or has an opacity that obscures observers' view of a degree equal to smoke described in another section of the code.

In upholding the conviction in this case the Appellate Department of the Superior Court in Los Angeles declared that the law was reasonable, that it could properly

incorporate a reference to a regulation of the Federal Government, such as the Ringelmann chart, and that exemption of certain agricultural operations, such as orchard heaters, did not constitute unreasonable discrimination[11].

The Ringelmann chart was devised about 70 years ago by a French scientist as a measurement for black smoke. It was introduced into the United States at the beginning of the present century, and was first mentioned in legislation in the air pollution act of Massachusetts in 1910. Having been used for more than 50 years, not only for black smoke but for blue, yellow and other plumes, it is generally accepted as a scientific measurement of certain types of air pollutants. It does not measure invisible emanations, which may also be troublesome.

In 1955 four suits for violation of the Los Angeles code were heard together on appeal to the Appellate Department of the Superior Court, which had to consider and digest 3200 pages of transcript in these cases. The court held that the standards set forth in the code were adequate to satisfy due process of law, that experienced inspectors could make mental translations of the Ringelmann chart, and that the convictions in three of the cases were justified. The fourth conviction was overruled on technical legal grounds, for failure of the trial court to instruct that the guilt must be proved beyond a reasonable doubt.[12] An appeal from this decision was dismissed by the Supreme Court of the United States.[13]

One wonders why these four prominent and influential corporations could not have complied with a law enacted in the public interest instead of going to court about it. Air pollution in this country has become a menace to health and property which requires drastic but reasonable legal action. From the record it is apparent that the courts will give every intendment in favor of legislative and administrative action to prevent and control this hazard. It is a settled legal principle that every business, no matter how lawful, must be conducted with due regard to the rights of others.

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12. People v. Plywood Mfgrs. of Calif. (1955), 137 Cal.A. 2d 859, 291 P2d 587.
13. Union Oil Co. of California, v. People of State of California (1956), 351 U.S. 929, 100 L.Ed. 1458, 76 S.Ct. 787, reh. den. 351 U.S. 990, 100 L.Ed. 1503, 76 S.Ct. 1046.

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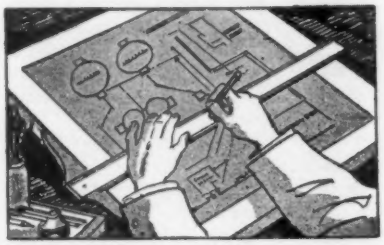

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Utility Changes Needed for Skyway Bridge

(*Continued from page* 144)

stock and the entire cost billed to the Skyway project.

Gas Line Relocation

The major gas relocation job was in the vicinity of the toll plaza where it was necessary to abandon and relocate 4000 feet of 36-in. main in Anthony Avenue in the vicinity of 87th and 90th Streets. Throughout this area, a complete new 36-in. mechanical joint cast iron feeder main was installed. This main was designed for 30 pounds pressure and connected in with the large holder located near Indianapolis Boulevard and 104th Street. This feeder main is a part of the east side loop that extends the entire length of the city.

The smaller distribution mains had to be relocated or changed at about 30 percent of the street intersection to provide room for the large retaining walls, piling, sewer changes, and other construction necessary in the building of the Skyway. A large regulator vault and assorted equipment had to be moved out of the Skyway.

Sewer Reconstruction

The sewers were deep enough and strong enough to carry the increased weight due to the extra backfill load. There were only a few changes in location and these were of the small diameter sewers for sanitary sewage; some 2500 ft. of 12-in. to 15-in. lines had to be relocated. The largest job was providing drainage connections from the Skyway into the trunk system. In Chicago the sewer system is divided between two organizations. The city takes care of the collection system and the Sanitary District builds and operates the large trunk sewers and treatment plants. The Skyway has a complete drainage system for its entire length with many discharge outlets ranging in size up to 48-in., all of which had to be connected to the trunk sewers as they were crossed over. All the sewer changes, connections, relocations, and the new drainage system was installed by the general contractors and paid for by the "Skyway", with inspection and design approval of the Sewer Department.

Electric Power

The electric utility company had to move large lengths of power cable ducts out of Anthony Avenue and Stoney Island Avenue to make room

for the Skyway. There were two heavy circuits in Anthony Avenue —one a 69,000-volt circuit and the other a 138,000-volt circuit. These had to be completely relocated.

The City attorney ruled that the private utilities would have to move their properties out of the street in advance of construction and at their own expense but that all of the city owned utilities would be reimbursed for their expenses in connection with utility relocations and changes by the Skyway.

The electric department of the city has found it necessary to maintain one line crew and one underground crew on the project practically all the time since the job started and on some days four or more crews are employed on the work. The city electric forces have to maintain the street lights, the fire alarm circuits, the police circuit, and the traffic signals. All of these are being moved out of the right-of-way and relocated in the adjoining area.

Construction Work

Actual construction work was started on the highway on June 5, 1956. This consisted in the clearing of the right-of-way; the actual building of new structures was started July 9, 1956. Work has progressed rapidly and only seven working days were lost during the extreme weather of January, 1957. The project is scheduled for opening to traffic on March 1, 1958. It had been scheduled for an earlier opening but due to the steel strike and the large quantities of fabricated steel to be used in the project, forty-eight extra days have been added to the construction period.

Of all the contracts involved in the completion of this project 96 percent have been let and only a few minor contracts are still under consideration. The City of Chicago retained the firm of De Leuw Cather & Company as the coordinating engineers to function in all matters relating to the construction of the Skyway Bridge, under the direction of George L. DeMent, Com'r. of Public Wks. The actual design of the various sections of the work was let out to seven large consulting engineer firms; with two specialized engineering firms being employed, one for the bridge design, J. E. Greiner Corporation, and the other for the determination of revenues and necessary rate basis, Coverdale & Colpitts. Roy Anderson is the supervising engineer for De Leuw Cather & Company, and John G. Duba is administrative engineer for the City of Chicago.

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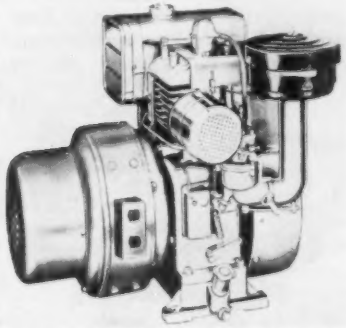
New Electric Generator Line

Pioneer Gen-E-Motor announces the production of a new line of electric generating plants. The line, called "Voltmaster", is designed with highly efficient electrical characteristics and without the "extras" offered as standard features on the deluxe plants. Complete details are available from Pioneer Gen-E-Motor Corp., 5841 West Dickens Ave., Chicago, Ill., or circle **No. 10-2** on the reply card.



Water and sewage departments can use these new electric generating plants

Jeep Becomes Car Towing Vehicle

The Jeep can now be converted into a low-cost towing vehicle by the addition of the Watson Towboy. This retriever crane includes models especially designed for the new "Forward Control Jeep FC-150 and 170", as well as for the Universal Jeep and long wheel base pickup trucks. Once installed, the towboy can be removed or remounted in five minutes and it can handle the majority of service calls now done by heavier equipment. It is hand winch-operated, with a 2-ton lifting capacity. Only two minutes are required to make the hookup. For further information write H. S. Watson Co., 1316—67th Street, Emeryville 8, Calif., or circle **No. 10-3** on the reply card.

Butterfly Valve

A new line of butterfly valves, featuring a unique rubber seating principle and unusual operating characteristics, is announced by Darling valve. Advantages of the valve include lower operating torque; adjustability of seat for tight shutoff; seat replacement without removal of shaft or operator; elimination of shaft sealing problems as the rubber seat is a continuous ring integral with the disc; and increased operating cycles before part replacement or maintenance is necessary. Sizes range from 4 to 72 ins. and pressures from the 50 to 250 psi range. The valves are designed for all types of manual and air or hydraulic cylinder operation. More details from Darling Valve & Mfg. Co., Williamsport, Pa., or circle **No. 10-4** on the reply card.

Scraper For Cat D7

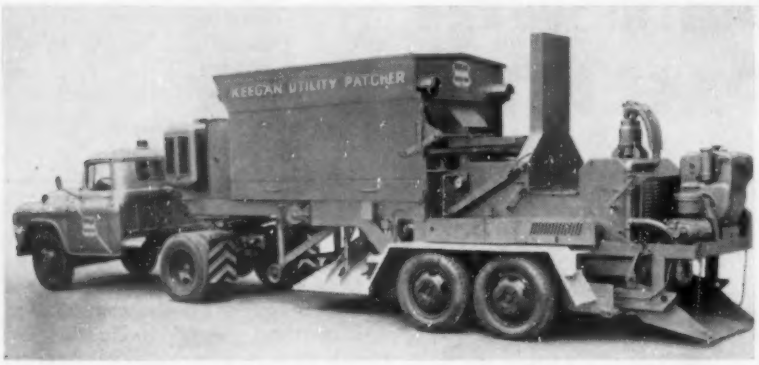
Lowbowl scraper design has now been made available for use with the Caterpillar D7 tractor. The new, four-wheel scraper, with the low silhouette allows material to enter the scraper with a minimum of lifting effort and material-to-material friction. The unit has a struck capacity of 13 cu. yds. and can transport 18 cu. yds. of heaped material. Protection against fouling of the draft arms due to rock spillage over the scraper sides is afforded by the incorporation of rock guards as standard on the new unit. For full details write Caterpillar News Service, Caterpillar Tractor Co., Peoria, Ill., or circle **No. 10-5** on the reply card.

Patching and Repaving Mixer

Designed for street and highway departments and for the contractor who specializes in medium and small jobs, in patching and repaving, the new Turbo-Mixer No. 15 is available from Asphalt Equipment Co. The mixer consists of an aggregate bin with a reciprocating feeder for proportioning aggregates, and a positive displacement pump to supply the asphalt. It has a three-compartment, three-shaft pugmill mixer and heating unit with a total of 18 feet of travel. It can work with regular asphalt cements, cutbacks or emulsions and can be electric, gas or diesel driven. It can produce 12 to 15 tons of asphaltic concrete per hour. For full data write Asphalt Equipment Co., Inc., Fort Wayne, Ind. or circle **No. 10-6** on the reply card.

Patching mixer can work with regular asphalt cements, cutbacks or emulsions

New Method of Permanent Road Patching



Keegan giant drying unit makes year round permanent patching of pavements possible

The Keegan utility patcher now makes it possible to patch pavements quickly, easily and economically; and with the added advantage that the patching is a permanent job. When the Keegan patcher arrives on location, the 250 degree heat dispensed by the heating hood burns out the hole where the road is to be patched and makes the existing pavement hot. While this is in process, the patcher is making the hot asphalt that goes into the patch and forms a positive bond between the pavement and the patch. There is no chance of leakage or of frost heaving the patch. The patcher consists of a Chevrolet chassis, an air compressor for cutting the pavement, a self feed loader which carries oil, dry material to make the hot patch, and binder. It is capable of making approximataly 30 tons of hot top per hour. Detailed information is available by writing to Keegan Utility Patcher, Dept. B, 3830 Monroe Ave., Pittsford, N.Y., or circling **No. 10-7.**

Electrical Control for Remote Valve Positioning

"Val-Con," a new electrical control for remote valve positioning, offers upper and lower valve limit signals plus meter indication of valve position. It operates over leased lines or standard 2-wire and ground systems. Controlled valve position, or other process variable dependent on valve action, is displayed on a 6-in. dial. Positive indication of upper or lower valve limits is accomplished through definite departure of the meter needle into color- coded segments at the extreme ends of the scale This indication is independent of all normal telemetering functions. Thus an operator is able to determine positively when the valve is open or closed. The unit is designed to operate with present motor controllers over any practical distance from a few feet to many miles. Two independent visual alarms are included for such functions as power failure, pressure, temperature and overload. Further details from Sparton Corporation, Sparton Controls System Division, Jackson, Mich., or circle **No. 10-8** on the reply card.

Control can operate over leased lines or standard 2-wire and ground systems

"Paymover" Towing Tractors

These Hough machines are the Model T-50 with 5,000 pounds drawing pull and the Model T-60 with 6,000 pounds drawbar pull, with both units equipped with two-wheel-drive. They are compact and maneuverable, featuring torque-converter drive and automatic transmissions. Head and tail lights are standard equipment and a wide variety of coupler attachments are available. For detailed specifications write The Frank G. Hough Co., 761 Seventh Avenue, Libertyville, Ill., or circle **No. 10-9** on the reply card.

Power Drive Pneumatic Compactor

A power drive multi-wheel pneumatic compactor designed for final grade bituminous paving, and soil-cement compaction is available from the Chester Products Co. Nine rolling wheels with 7.50 x 15 smooth tires are pair-mounted for maximum oscillation in a "coverall" pattern with four wheels in front and the rear wheels extending beyond the body in order to permit operation close to obstacles. Maximum compactive effort is 2,000 pounds per wheel with water ballast. Rolling width is 66 inches, ground clearance is 15 inches, and body height is 52 inches. Construction of the fifth wheel permits short radius turns. Features are power steering, double-disc brakes, an elevated operator's seat and a gasoline engine rated at 38 bhp at 2000 rpm. Transmission provides 6 forward and 2 reverse speeds. For further information write to Chester Products Co., N. Fifth Street and Ford Boulevard, Hamilton, Ohio, or circle **No. 10-10** on the reply card.

One Man Operated Truck Crane

A new, fully hydraulic, one-man operated truck crane has been announced by Stanco Manufacturers and Sales This unit requires only 15 ins. of space between the cab and truck bed, leaving the entire truck bed open. This crane, the Hiab 170, offers a range of lifting capacities from 6000 pounds on the shortened boom of 5 feet, to 2500 pounds on the full boom of 13 feet. The boom length is easily adjustable through hydraulic control. The crane will lift up to 20 feet above ground level at a maximum speed of 20 inches per second. Control is from either side of the truck cab. It is ideal for machinery, tire and pipe handling, loading and unloading of crates and boxes. For complete information write Stanco Manufacturers and Sales, Inc., 1931 Pontius Ave., Los Angeles 25, Calif., or circle **No. 10-11** on the reply card.

Crane action is positive and accurate and swings in complete 360 degree arc

M-B Garbage and Refuse Body

Garbage and refuse packer body has improved body design

M-B Corp. announces a new version of the M-B garbage and refuse packer body. Improved body design and greater carrying capacity on shorter "CA" trucks are some of the new mechanical advancements. New body dimensions allow mounting on a shorter wheelbase truck with no loss of total load capacity. Larger side loading doors make loading odd-sized material easier. A powerful electric clutch and quiet-operating drive, run in oil, are fully enclosed. Only two bottom cables are used in the simplified cable arrangement, resulting in a more "stabilized" packer plate having greater packing effectiveness. Write the M-B Corp., New Holstein, Wis., or circle **No. 10-12** on the reply card.

Hydraulic Hole Digger

The addition of a hydraulic hole digger to its Powers-American line of utility bodies and equipment has been announced by McCabe-Powers. The digger, designated "Earth-Master," is fully-hydraulic in operation, being powered by a hydraulic pump driven by the truck engine. It will dig holes up to 9 ft. 4 ins. in depth, at various angles, in practically all types of soil. The auger is guided at all times, to assure straight, clean holes. It travels up and down on a twin-column support frame which can be turned to various positions and extended or retracted to fit terrain and working conditions. The digger controls are normally installed beside derrick controls in a rear body compartment, to give the operator full view of all digger and derrick movement. For complete information write McCabe-Powers Auto Body Co., 5900 North Broadway, St. Louis 15, Mo., or circle **No. 10-13.**

Deere Tractor Units Available

Crawler-loaders are used in earth-moving and snow removal

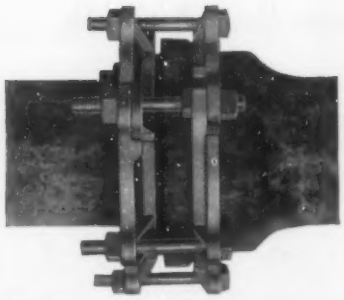
Two of the new tractor units offered by John Deere are used by construction and maintenance departments. The crawler-loader is used on many community earth-moving and materials handling jobs including snow removal. This unit delivers 30 engine hp. and the loader has high lift, with a choice of bucket sizes. The utility wheel-type tractor (30 engine hp) equipped with a backhoe and a front-end loader is a well-balanced combination. The loader has a full-height lifting capacity of 2000 pounds; backhoe has maximum digging depth of 12 feet, with digging arc swing of 160 degrees. Several sizes of backhoe buckets are available. For full details write John Deere Industrial Div., Moline, Ill., or check **No. 10-14** on the reply card.

Self-Propelled Pneumatic Compaction Roller

A new design in self-propelled pneumatic compaction rollers is offered by the 9 and 11 ton Vertical-Pak roller made by Southwest Welding. The new unit affords vertical oscillation through the vertical action of the rear wheels. Vertical oscillation provides a constant, uniform wheel load as well as uniform capacity on uneven surfaces, over soft spots, and where stones or boulders are present in the materials undergoing compaction. Tests show the Vertical-Pak action reduces tire hazard as much as five times. The operator is in a position to see both forward and reverse equally well at speeds in both directions up to 15 mph. Ballast capacity is 120 cu. ft. Overall length of the machine is 13 ft., height is 78 ins., and width is 84 ins. The roller is available in both 11-ton, 11-wheel models, and 9-ton, 9-wheel models. For complete information write Southwest Welding & Mfg. Co., Construction Machinery Div., Alhambra, Calif., or circle **No. 10-15** on the reply card.

Cormac Photocopier Is Fast, Copies 30 Percent Larger

A new office photocopy machine, with a 30 percent greater copying size capacity, has been announced by Cormac Industries. The machine takes less than 15 seconds to make a standard copy, has a maximum copying width of 18¾ ins. plus 3¾ ins. to spare for easier handling and no limit on length. It reproduces in black-on-white everything that can be seen on the original including fountain or ballpoint ink, colors and spirit duplication. A new Micro-Dial control designed to reduce about 80 percent exposure-setting errors, and a trap device which automatically guards against accidental paper insertions are included. The unit is capable of turning out more than 2,500 letter-size copies in one eight-hour day. Full data from Cormac Industries, Inc., 80 Fifth Ave., New York 11, N. Y., or circle **No. 10-16** on the reply card.



Clamp is used on bell and spigot pipe

Bell Joint Clamps

A complete line of bell joint clamps in sizes from 4 through 30 ins. is now being manufactured by the Joslyn Mfg. and Supply Co. The clamps consist of two segmental, malleable iron rings, a combination single ring gasket made of two hardnesses of rubber, and a set of clamping bolts. The soft rubber portion of the gasket quickly seals off any leak in the bell and spigot joint; the harder outer portion of the gasket engaged by the spigot ring resists cold flow and holds the gasket under permanent pressure. With this unusual design, joints can be made tight before bolts are fully drawn up, thus providing a high factor of safety. They are easy to install, completely effective in permanently stopping leaking joints and are economical to use. Further details from Joslyn Mfg. and Supply Co., Wm. E. Pratt Foundry Division, 155 North Wacker Drive, Chicago 6, Illinois, or circle **No. 10-17** on the reply card.

Reducing Evaporation from Reservoirs

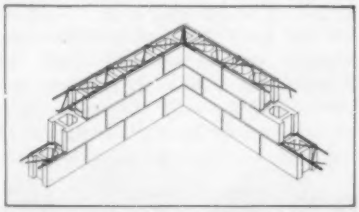
A new product which reduces the evaporation from reservoirs by forming a monomolecular film barrier on the surface of the water has been developed by American Alcolac Corp. Samples are available without charge for field tests by water districts, municipalities, industrial concerns or others. A combination of fatty alkanols, tradenamed Siponol EGH, the new product reduces evaporation as much as 50 percent under favorable conditions. It is supplied as a five-pound slab and may be anchored in a definite position on the water surface. The monomolecular film is established automatically by the chemicals spreading out radially from the slab until confined by a physical barrier — e.g., shoreline, tank edge. Back pressure then stops further spreading of the material, the remaining portion of the slab acting as a reserve to repair breaks in the film and replenish film that is lost. The film is permeable to oxygen, so that aquatic life is undisturbed by its presence. If the film is broken by a strong prevailing wind, it quickly reforms on change in direction or cessation of the wind. In addition, since the material is resistant to bacteria attack, it is long lasting. For further details, write to American Alcolac Corp., 350 Fifth Ave., New York, N.Y., or circle **No. 10-18** on the reply card.

Bennett Bilt Closed Drop-In Waste Receptacle

A complete new line of chrome plated waste receptacles has just been announced by The Bennett Mfg. Co. Double corrosion resistance is provided by the chrome plated finish and the phosphate treatment over the chemically cleaned heavy gauge steel. Self-closing overlapping top door with silent spring action makes depositing refuse easy. Included with each receptacle is a round galvanized liner with a full swing handle for fast emptying by simply removing the one-piece outside cover. These galvanized liners are water-tight, rust-proof and sanitary—ideal for depositing cups and similar wet waste. For complete information write to The Bennett Mfg. Co., Alden, New York, or circle **No. 10-19** on the reply card.

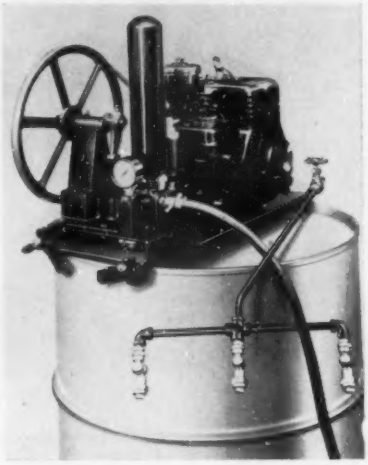
Masonry Wall Reinforcing

Butt weld, trussed design Dur-O-Wal is a steel reinforcing member that lays in the mortar joint of masonry walls. It gives the greatest possible lateral strength to walls and prevents the development of cracks. It is made from high tensile steel rod. All rods are in a single plane and are stiffened so they lay



straight and are easy for the mason to handle. A mechanical mortar lock or tie is created at each of these welds, which prevents slippage in the wall. For full details write Cedar Rapids Block Co., 650 Twelfth Ave., S. W., Cedar Rapids, Ia., or circle **No. 10-20** on the reply card.

Silicone Water Repellents Applied by Pump



Pump used for applying waterproofing

A unique pump for applying silicone water repellents to any masonry structure is announced by Campbell-Hausfeld. The unit is for applying silicone type water repellents above ground to brick, concrete, concrete block, cinder block, and sandstone; and pitch base coatings below grade before backfills are made. This unit, designed especially for flow-on silicone type materials, discharges up to 1½ gallons a minute, with pressure adjustable for any height structure. Mounted on a steel base, the waterproofer fastens and locks on top of a standard 55-gallon material drum with a unique winged bar arrangement. It is powered with 1½-hp four cycle gasoline engine or electric motor. Complete unit includes hose and three-nozzle applicator. For further details write Campbell-Hausfeld Co., Harrison, Ohio, or circle **No. 10-21** on the reply card.

Light-Weight Concrete Saws

Two new light-weight Target concrete saws are now being made by the Robert G. Evans Co. The Model 75 equipped with a 7½ hp Wisconsin air cooled engine provides a unit light enough to lower easily into a basement, compact enough to go through doorways and to maneuver easily around machinery, light poles, manholes, etc. The 18 hp Model 180 is light and quickly maneuverable to make short work of repair and patch jobs. Dual blade shaft permits cutting from either side. For full details write the Robert G. Evans Co., 6024 Troost Avenue, Kansas City 10, Mo., or circle **No. 10-22** on the reply card.

Fire Hazard Eliminated in Asphalt Reconditioning

The Monatco Heater-Planer, a machine for one-pass reconditioning of asphalt streets, highways and airport runways, has been completely re-designed. The Model M-2 places main drive engine, primary transmission and steering over the front axle, out of the heat zone. Operator, fuel tanks, secondary transmission and final drive are well to rear of the heat zone and all parts in the heat zone subject to heat damage are water-cooled. Two automatic fuel cut-offs provide final assurance against fire. It features standard automotive parts throughout, in clutch, transmission, full-time power steering and modern air brakes. Powered by a 90 gross bhp Continental engine, the machine has 15 forward speeds, 8 ft./min. to 25 mph, and 3 reverse speeds. Turning radius has been shortened to 21 ft. This machine heats, softens, planes and conditions asphalt in one operation. The surface is left raw, smooth and clean, conditioned for seal coating and/or resurfacing. For complete information write Monatco Mfg. Corp., 1401 Woodland, Kansas City, Mo., or circle **No. 10-23** on the reply card.

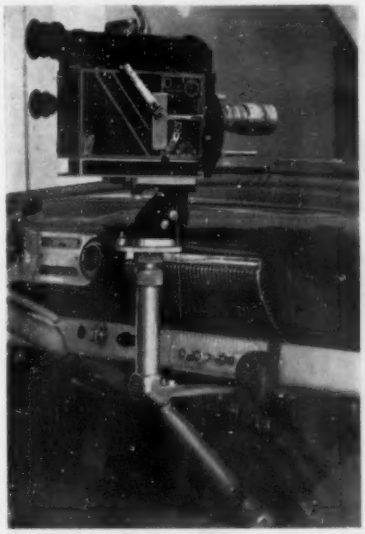
Henry Pipe Pusher

A new attachment, custom-built for the Henry hydraulic backhoe, drives pipe or service lines under roads, sidewalks or lawns with dead-eye accuracy. Called the Henry Ram-A-Rod, this pipe pusher will push or pull ¾ to 3-in. pipe or tubing. The pusher is a compact unit which replaces the bucket on the Henry backhoe. The Henry hydraulic system and ground-rooted mainframe hold the pusher in a fixed position. The bucket cylinder provides the actuating power. It has a 6-in. driving stroke and will deliver approximately 30 tons of pressure on the push pipe. One man can dig the trenches, replace the bucket with the pipe pusher, and handle the entire pushing job. It will push through sand, clay or rocky soil, and it has pushed over 100 ft. of ¾-in. pipe with no apparent strain. For further details write to Henry Mfg. Co., Inc., 1700 N. Clay St, Topeka, Kans, or circle **No. 10-24** on the reply card.

Pipe pusher is a self-contained unit that can drive pipe or service lines

Camera Mount For Accurate Photos

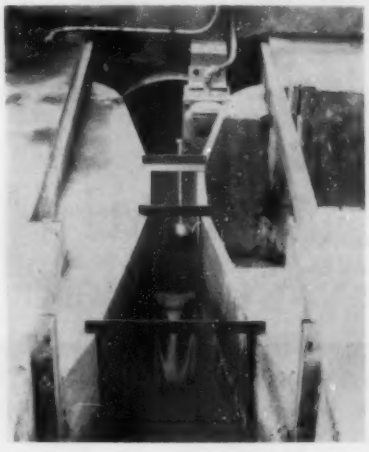
For several years local police and state highway patrols have been equipping police cars with a camera mount called the Triangle-J Autopod. It holds a camera steady so sharp, useful pictures can be shot through the windshield while the car is standing still or in motion. The built in vibration dampener permits sharp and accurate pictures with both still and movie cameras. Any type of camera can be mounted on the Autopod. The camera support can be mounted in a passenger car, jeep or truck. It is clamped to the underside of the dashboard and braced to the floor, mounted either right or left of the steering wheel. The camera can be operated by the driver using a cable release, or by a cameraman riding as a passenger. Contractors and engineering departments of construction organizations are using cameras mounted on Autopods to photograph rights-of-way and proposed sites for rock plants and storage yards; to record daily progress reports on highway and engineering projects, road conditions and road hazards; to show traffic flow past certain points, transmission lines and sign locations; and for evidence pictures in accident cases. For full information write Jewett Mfg. Co., 201 East Del Mar Place, San Gabriel, Calif., or circle **No. 10-25** on the reply card.



Take photographs from moving car.

A New Look In Sewage Measurement Units

A new Parshall flume for the measurement of sewage flow, called the type ML, is announced by Burgess-Manning. The ML unit eliminates the need of a stilling well and cover, connecting pressure piping and fittings, cleaning valve, back flushing devices and float cable. Another important feature is that the new design allows it to remain deposit free. The unit has a 4-in. diameter stainless steel float, and float rod, and a core and coil transmitting device mounted in a waterproof casting which is attached to the side of the flume or which is suspended from or attached to a cross piece at the entrance of the flume. The float rides on the surface of the water and about 87 percent of the float is completely out of the water so that sewage, rubbish, debris, etc., can ride through the flume without becoming engaged with the float itself. The recording meter can be installed anywhere up to 5,000 feet from the flume. Power is required at the receiver end only and the sewage flow is recorded on a 12-in. uniformly graduated chart designed for weekly or daily removal. The unit can be adapted for measurement of flows across weirs or through open flow nozzles. For further details write Burgess-Manning Co., Penn Instruments Div., 4110 Haverford Ave., Philadelphia 4, Pa., or circle **No. 10-26** on the reply card.



STOP this guy!

The sharp beam from a Beacon Ray can cut off his implement of death.

Let Beacon Ray and FireBall lights cut highway deaths and accidents, especially where highway maintenance men and vehicles are involved.

The Beacon Ray's 360° revolving beam will alert the speeding, inattentive, or incompetent driver in ample time for his slow judgment to be effective. Warn him in time to save lives, including his own.

Equip nd protect your mowers, linemarkers, snowplows, cinder trucks, and similar service vehicles with famous FEDERAL Beacon Ray or FireBall lights. Cheaper substitutes will prove more costly.

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Write for Vehicle Warning lights bulletin, today

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The world's finest low-cost precision testers.

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If it's a concrete tester you need—get in touch with

FORNEY'S, Inc.
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P. O. BOX 310 · NEW CASTLE, PA.

8,000-Hour Traffic Signal Lamp

Several sizes of lamps are available

An improved line of traffic signal lamps with a new life rating of 8,000 burning hours for the 67-watt size is announced by Duro-Test Corp. Included in the line are 25, 40, 60, 100 and 150-watt sizes with a burning life to 5000 hours. Duro-Test's projection-type filament specifically designed for these lamps enables traffic signals to aim the highest concentration of light slightly below horizontal, directly towards the eyes of approaching motorists. The 150-watt Super "V" Beam which fits both 12-in. and 8-in. signals is a new addition to the line to meet the demand for more light in the red sections of traffic signals on main arteries and on street corners where visibility is affected by sun phantom. For more data write Duro-Test Corp., North Bergen, N. J., or circle **No. 10-27** on the reply card.

Quantichem Colorimetric Analyzers

Milton Roy Co. has announced the availability for industrial installation of their new Quantichem automatic analyzers. The new instruments will continuously analyze water for total hardness or silica concentration. Each analysis is on a fixed time cycle with the results recorded on a separate unit that may include alarms or control devices. The silica analyzer has a range of 0 to 0.05 ppm. The standard ranges for the total hardness analyzers are 0-3 and 0-5 ppm with a sensitivity of 0.03 and 0.05 ppm respectively, calibrated as calcium carbonate. Other ranges are

available to meet special applications. In effect, the analyzers are miniature laboratories which automatically perform all steps of an analysis from the flushing of the sample cells and calibration of the photoelectric measuring circuit to the metering of reagents and the recording of the results. When the analysis is completed, the analyzer immediately starts testing a new sample. Each silica analysis takes 12 minutes while each hardness analysis takes 6 minutes. The recorders are equipped with adjustable "high-lo" limit switches that can be set at any value within the instrument range. The analyzers are automatically calibrated in each cycle and pilot lamps flash when the cells must be cleaned or the light source must be replaced. Water to be tested must be available at pressures above 10 psi and temperatures below 100°F. For more details write Milton Roy Co., 1300 E. Mermaid Lane, Philadelphia 18, Pa., or circle **No. 10-28** on the reply card.

6-in-1 Soil-Working Tool

A new six-in-one soil-working tool which will release five to ten men for other work is included in the Sherman-Gill line of tractor-attached equipment which have been added by Sherman Products. The six-in-one tool eliminates expensive hand labor and greatly reduces the time usually necessary in preparation for seeding. The unit features a "floating design" which depends on its own weight to penetrate the soil. Used immediately after bulldozing or grading, the unit eliminates the need for plowing and discing. It scarifies with its 33 teeth which penetrate four inches into the soil, grades, levels with its "H" beam and flange, breaks clods, pulverizes with its 110 pins in each roller, and rolls and compacts. The seeder attachments are available in three-bushel single section and four-bushel double section sizes. For full data write Sherman Products, Inc., Royal Oak, Mich., or circle **No. 10-29.**

Tool for preparing soils for seeding

CLASSIFIED ADVERTISING AND JOB OPPORTUNITIES

POSITION VACANT
UTILITIES ENGINEER

The position assists the Superintendent of Water and Sewers in the administration of the water and sewage systems.

Considerable experience in a progressively responsible technical and administrative capacity including engineering and operations experience in a water utility and sewage system. Graduation from a four-year college or university with specialization in Civil, Mechanical or Sanitary Engineering. Eligible to be registered in the State of Arizona. An applicant for Arizona registration shall be age 25 or over and have 8 years engineering experience for which up to 5 years of training or teaching in engineering may be equated.

$725-$795 per month.
Age Limits—25 to 55.
Apply by November 1, 1957 to

Leroy J. Brenneman
Personnel Director
City Hall
Phoenix, Arizona

SEWAGE PLANT
SUPERINTENDENT

The City of Roanoke, Virginia has available as of October 1, 1957 a position as Plant Superintendent, Sewage Treatment Plant.

Salary Range—$420.00-$540.00 per month (1956 Job Class. Comm. Report). Position carries Pension Plan, Sick Leave, and Vacation. Retirement age 65.

Qualifications: Should have B.S. in Sanitary, Civil, or Chemical Engineering and possess at least 5 years operational experience in an activated sludge plant. (Sect. 110-3, Job Description, City of Roanoke).

Plant Data: Type: Standard Activated Sludge Process Capacity: Designs: 14.00 M.G.D. including 25% Return. Present: 11.47 M.G.D. plus 39% Return. Number of Personnel: 19.

Application accompanied with photograph, setting forth training and experience, to be made to:

Mr. A. S. Owens
City Manager
Roanoke, Virginia

SANITARY ENGINEERS WANTED

Sanitary Enginers II and III; salary ranges $460-575, $575-725 respectively; two to four years' experience in public health or sanitary engineering; excellent retirement and fringe benefits; liberal leave policy and travel allowances.

Write to:

Personnel Officer
Florida State Board of Health
P. O. Box 210
Jacksonville 1, Florida

FOR SALE

Complete portable floodlight equipment for all sports. Can be installed in 1½ hours. Diesel power, A. C. current. Price includes two trucks. $20,000.

Write to:

Box 10-1
Care of Public Works Magazine

CIVIL ENGINEERS WANTED

Civil Engineers are wanted with experience in the fields of Highway Design, Structures, Water Distribution Systems, Sewers, Sewage Treatment, Pumping Stations and Storm Drains. Public Works experience desirable but not essential. Good starting salary; excellent working conditions, stable community; fine opportunity for advancement. Merit System increases and Retirement benefits. Send resume of experience and salary desired to:

Department of Public Works
Baltimore County Office Building
Towson 4, Maryland

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Various Styles, Sizes and Weights
Adjustable Curb Inlets
Water Meter Covers
Cistern and Coal Hole Covers
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Gutter Crossing Plates
Valve and Lamphole Covers

Write for Catalog and Prices

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Gray Iron and Semi-Steel Castings
SOUTH BEND 23, INDIANA

Sewerage and Sewage Treatment

By COL. W. A. HARDENBERGH

Editor, Public Works Magazine; formerly Chief, Sanitary Corps, U. S. Army

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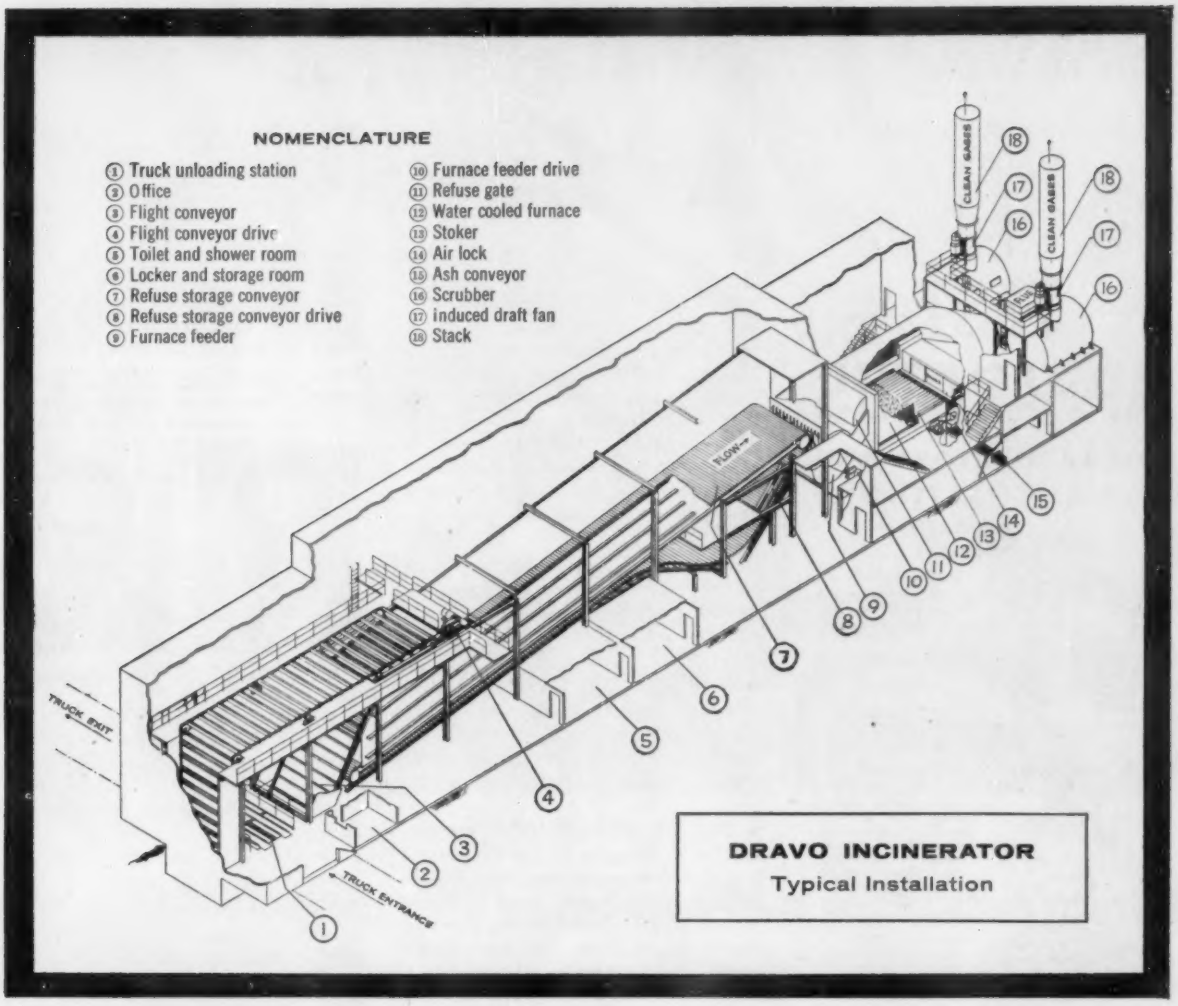

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by Arthur K. Akers

★ NEVER MIND Marilyn Monroe—have you seen the 16mm full color, sound movie available from Jerry Thomas, Advertising Manager, Layne & Bowler, Inc., Memphis 8? It shows something you never saw before; underground pictures of how water reaches sub-surface formations and is gathered, pumped and delivered thereafter.

★ FRANK HINDS is appointed as Vice President, U.S.A. Sales, of The Master Builders Co. division of American-Marietta Co., Cleveland.

★ THEODORE S. PETERSON has been named Sales Manager, the "Quick-Way" Truck Shovel Co., Denver, succeeding Daniel S. Heffron.

★ PLANT EXPANSIONS include that of S. Morgan Smith Co., moving all valve operations from Philadelphia to what will be the largest rotary valve manufacturing plant in the U. S., at York, Pa. Allis-Chalmers Mfg. Co. broke ground for a new $3¼ million engineering and research laboratory at their Harvey, Ill., works.

★ ECONOLITE CORPORATION of Los Angeles has made a huge purchase—of the traffic signal and control business of the General Electric Co. Equipment, tooling stock, etc., is now being moved from G.E.'s outdoor lighting factory at Hendersonville, N. C. Aubrey "Red" Matthews is named General Sales Manager for Econolite. For further details, see their ad on Page 231 of September PUBLIC WORKS.

★ STOLPER STEEL PRODUCTS CO., Menomonee Falls, Wis., has purchased Allen Industrial Products, Battle Creek, Mich., makers of cabs for industrial trucks and construction equipment. And a new plant addition increases manufacturing space about 40%.

★ U. S. registrations of Willys Motors "Jeeps" increased during the first half of 1957.

★ WESLEY V. DAVIDSON is promoted to General Sales Manager, Road Machinery Division, Standard Steel Corp. of Los Angeles and Decatur, Ill.

Mr. Davidson

Mr. Chadwick

★ JOHN E. CHADWICK, formerly Sales Manager of Koehring Division, Milwaukee, is named Vice President and Sales Manager in charge of sales, service and sales promotion. He succeeds John S. Conway who died August 17 after a short illness.

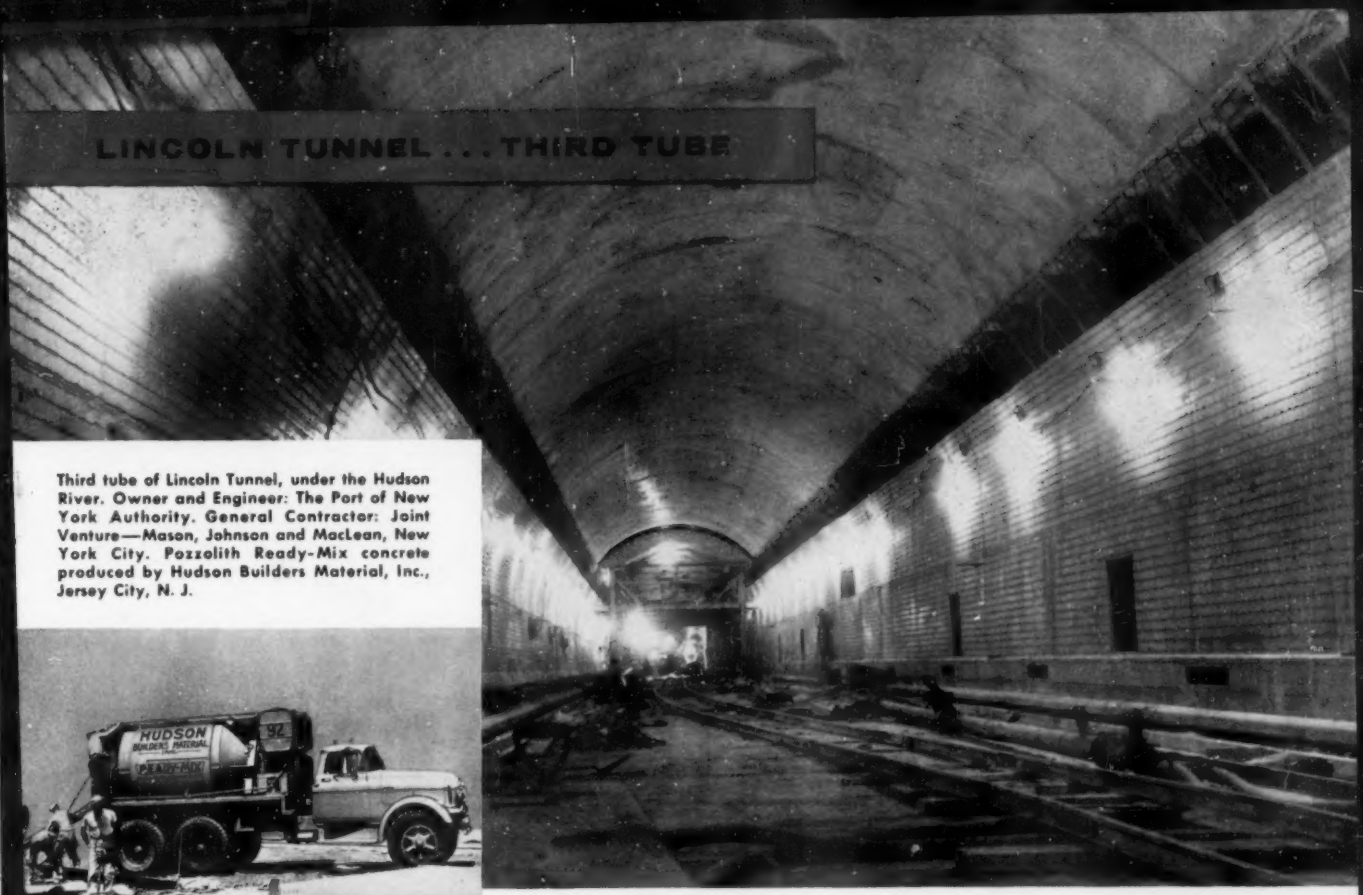
★ CHARLES J. DAVIS, newly-appointed General Manager, Industrial Division, Massey-Harris-Ferguson, will head up this division in Wichita, Kansas. Mr. Davis, formerly President of Mid-Western Industries, developed, produced and sold the Davis Back-Hoe, Loader, and Pit-Bull.

★ JOHNSTON PUMP CO., Pasadena, has opened a new warehouse and assembly center in Hastings, Neb., with Bob Triplett moving from Kansas City to assume charge.

★ PIPPIN CONSTRUCTION EQUIPMENT, Inc., White River Junction, Vermont, has been purchased by The Cone Automatic Machine Co., Inc., Windsor, Vermont. M. J. Pippin will be General Manager of the new Conomatic-Pippin Division.

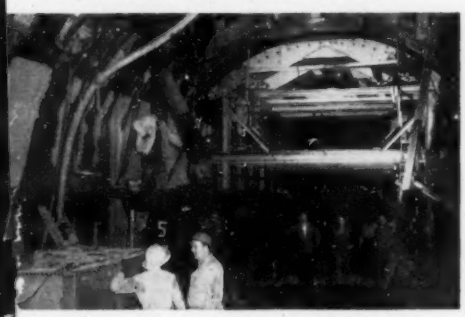
★ ONE business man to another: "I wanted my son to share in the business, but the Government beat him to it."

—*Small Business News*

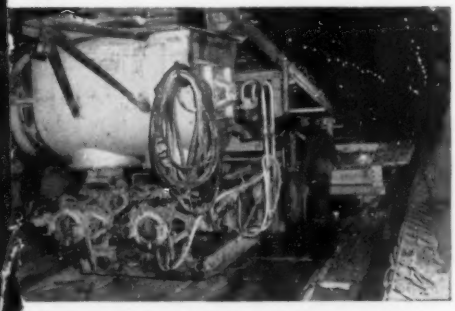


Third tube of Lincoln Tunnel, under the Hudson River. Owner and Engineer: The Port of New York Authority. General Contractor: Joint Venture—Mason, Johnson and MacLean, New York City. Pozzolith Ready-Mix concrete produced by Hudson Builders Material, Inc., Jersey City, N. J.

Ready-mix truck on top side of tunnel discharges concrete into "elephant trunk" . . .



Concrete goes down "elephant trunk" to buggies in tunnel . . .



Concrete pump receives concrete from buggies and pumps it into tunnel lining forms.

"Triple-Play" Concrete . . . with POZZOLITH

From ready-mix truck . . . to buggy . . . to concrete pump . . . to tunnel lining—"triple-play" handling while retaining good flowability and minimum bleeding—this was the performance of concrete produced with Pozzolith in the construction of The Port of New York Authority's $100,000,000 Lincoln Tunnel third tube.

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